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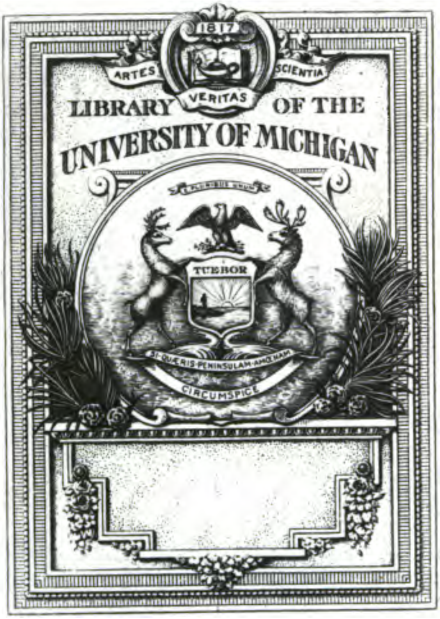

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THE

LEEDS CORRESPONDENT,

A

LITERARY, MATHEMATICAL, AND PHILOSOPHICAL MISCELLANY.

THE MATHEMATICAL DEPARTMENT

EDITED BY

JOHN WHITLEY,

WOODHOUSE GROVE, NEAR BRADFORD.

Tarda fluunt ingrataque tempora, quæ spem
Consiliumque morantur agendi gnaviter id, quod
Æque pauperibus prodest, locupletibus æque;
Æque neglectum pueris senibusque nocebit.
HORAT.

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PREFACE.

On completing the Fourth Volume of THE LEEDS CORRESPONDENT, the Proprietor embraces the opportunity to return his grateful acknowledgments to his numerous friends for their continued patronage of this Miscellany. He is happy to observe, that the change from a *Half-yearly* to a *Quarterly* mode of publication has afforded much satisfaction to several of the purchasers and contributors; and while he assures them, that he will strive by every means in his power to merit their approbation, he informs them, the work will hereafter make its appearance on *the last day* of January, April, July, and October, and will consequently be ready for delivery with the February, May, August, and November Magazines. This arrangement is, on many accounts, one of greater convenience. At the close of the next Volume, it is not improbable, the suggestion of some friends may be adopted, in reference to a New Series printed in OCTAVO.

Several of our Mathematical correspondents complain, that the late numbers have contained a far greater portion of *Geometrical* than of *Algebraical* questions and solutions. That Geometry has assumed such a preponderance, is very true; but it is owing greatly to the complainants themselves, who, in their various contributions to the list of *New Questions*, have neglected to transmit many of those which relate to Algebra. Mr. Whitley, therefore, in the exercise of his accustomed discretion and impartiality, and with an anxious desire to please all parties, complied with what appeared from their communications to be the prevailing wish of the Mathematical Correspondents, and gave a greater prominence to Geometry. But, to gratify a few individuals, more Algebraical questions will be offered for solution in the succeeding numbers.

To the Proprietor it is a source of great pleasure—a feeling in which all his *Mathematical* friends will sincerely participate,—that Mr. Whitley not only continues to superintend that Department of "the Leeds Correspondent" in a manner every way worthy of himself, but enriches its varied pages with many of his own invaluable productions. He is now about to retire from an Institution, to whose rising interests he has for some years most sedulously devoted the best of his powers, and whose prosperity he has contributed essentially to promote. When he quits the Sparta which he has in such a distinguished manner adorned, he will carry with him the regrets and good-will of the most judicious friends of that infant Establishment. But, whether he may commence an Academy on his own account in Leeds, or any town in its vicinity, his esteemed connexion with "the Leeds Correspondent" will not be interrupted. In whatever place his abode may be ultimately fixed, his professional services will prove highly advantageous to those who may be placed under his tuition; and, it is hoped, his talents and diversified acquirements will be duly appreciated by the inhabitants.*—A fainter eulogium than this the Proprietor could not be induced to pronounce on a man whose friendship has been to him an uncommon gratification; and to whose meritorious exertions, this Miscellany is deeply indebted for its increasing success.

We shall endeavour to furnish extracts from the most recent and important publications, and to give a greater amplitude and variety to the contents of our Literary Department. As our limits are exceedingly circumscribed, those communications alone which are of the greatest interest, can obtain insertion; and we shall feel happy to see our pages better filled with essays and narratives of a description truly original.

This publication is always ready for delivery at the periods announced. If therefore any of our friends be irregularly supplied with it, the fault rests either with the country bookseller or with his London Correspondent.

J. N.

Sept. 21st, 1822.

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* *It is very probable that Mr. Whitley will open an Academy in the flourishing town of* BRADFORD.

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HORAT.

No. I. JANUARY, 1822. Vol. IV.

ON NATURAL GENIUS.

When we see a person excel in some particular department,—whether it be in the study of languages, in the researches of antiquity, in the invention of the mechanic, or in the ingenuity of the artificer, in philosophical discoveries, or in superior proficiency in the fine arts,—we naturally enough exclaim, "He is a clever fellow—was born a painter or a poet, or whatever it may chance to be,—he is evidently *a natural genius.*" This indeed is an easy way of settling the question, of satisfying our own minds, or more properly of consoling ourselves under our own deficiency: but it is, at least in my opinion, devoid of reason, contrary to the analogy of things, and consequently far from the truth. It has been my lot to meet with many persons of all ranks, accounted sensible and wise, who have strenuously defended this opinion; and I am also aware that it is a popular doctrine, and on that account bad to be dislodged, being maintained by prejudice: yet this is no argument for its correctness, no rule why it should not be combatted, in as much as the multitude may be, and generally are, in the wrong, and to endeavour to set them right is a laudable undertaking.

The celebrated Sir A—C— in delivering his introductory lecture to a numerous class of students, speaking of the late Mr. Hunter, perhaps the most experienced and scientific surgeon this country ever produced, remarked that when Mr. Hunter's skill blazed in its richest splendour, it was said that *he was born a genius,*—" I will tell you what he was, (said the lecturer,) he was a genius of indefatigable industry, of unbounded research, and unwearied perseverance; and such a genius may each of you become if you pursue the same means." Such exactly is my opinion: it is the resolution and stability, the diligence and its continuance, that constitute the *genius.*

To this it may be objected:—" Why then do we see that predilection for particular branches of art or science, and that eminence in them, which many display while they either reject others or are ignorant of them?" To give a complete answer to this question, would require such an acquaintance with human nature as no human being possesses. But it will generally be found, upon minute enquiry, that the taste for some particular pursuit, or the dislike to it, first arose from trifling and accidental causes; as for instance, the kiss of his mother made WEST a *painter,*—that commending smile which approved his puerile attempt, and applauded his little production, stimulated him to still greater designs, and to more extensive exertions. The disgraceful act of deer-stealing, and the consequent dread of punishment, forced SHAKSPEARE to quit his native town, where otherwise he might have lived in obscurity, or been distinguished in some other manner. But he was induced to come to London, where his introduction to the stage as an underling in theatric office, directed his mind to the drama, and stamped him a *Poet.* Every one who is familiar with the biography of the great, might adduce instances innumerable in support of this position. The most mighty geniuses have often received their first inclinations and dispositions to the art which they subsequently adopted, and in which they were conspicuous, from circumstances in themselves comparatively insignificant. The common experience of every day may be added in confirmation. How often have

I, whilst considering this subject, observed instances of its accuracy! We have known boys take an aversion to a study of the languages from the stupid remark of some school-fellow, which neither time nor persuasion could ever eradicate. We have seen the judicious treatment of a master call forth and then foster some peculiar disposition, which, had it not been thus elicited, would perhaps never have appeared. We have known a single observation cause a youth to abhor the very sight of a book, and some other equally immaterial occurrence attract his attention, and cause him to follow some mechanical calling. Indeed, let any of us look back upon our former lives, and weigh circumstances together, and we shall be able almost individually to discover the secret spring which primarily moved us to that in which by constant application we have at length begun to excel. Besides, is it not derogatory to the God of nature, to imagine that one man was born for this, and another for that especial department, to the exclusion of every other? And is it fair reasoning, to suppose that the great strength and energy of mind which carried a *natural genius* to the highest pitch of eminence and perfection, would have failed to bear him equally triumphant had he attempted any other undertaking?

But it is in vain to dispute with those who tenaciously and obstinately hold a contrary opinion, as they have a very expeditious method of closing the debate. If a man shine in this branch of science, "He had a natural inclination for it:" If he shine in that branch of the arts, "He was born a genius." Demosthenes is a strong instance of this truth; for he was directed to the study of rhetoric and elocution, by accidental circumstances. If he had remained a stammering clown, nothing would have been said about him; but when his continued practice and perseverance made him the "thundering orator of Greece,"—then, forsooth, "He was born an orator." So that, however pertinent the proofs which you may adduce, they are incompetent to overturn this sweeping and unreasonable hypothesis. But those who are not thus prepossessed, appreciating the justice of these observations, will at once perceive the notable requisites which enter into the composition of a genius.

The mind of youth is extremely soft and tender; like wax, it will receive any impression, but particularly the first, which, when once affixed, is with difficulty effaced. It would be foolish to suppose, that a tree must grow either uprightly or crooked, either in a straight line or in a curve;—it is,

"Just as the twig is bent the tree's inclin'd."

It is evident, that in these remarks, I speak of mankind in the mass. I am by no means disposed to affirm, that the rule is universal in its application. For instance, we do not say that one who had been a cripple from his birth, would make an excellent pedestrian; or that a natural ideot might by application become qualified to fill the professorial chair of Sir Isaac Newton. But these exceptions strengthen the argument; for the logician tells us, "the exception proves the rule." Upon the whole, it will be found, that my hypothesis is a correct one; and, upon the minds of young people, this consideration ought to be constantly impressed, "Whatever man has done, man may do." Let no one persuade my young friends, neither let them persuade themselves, that they have no abilities for such and such pursuits. If we meet with an ignorant person, he will generally allege in excuse, "I never had any *natural* inclination for such a pursuit." This is a convenient doctrine, by which to appease conscience, that charges us with want of inclination, and to comfort ourselves under deserved disgrace.

Be not you, my young friends, led astray by this delusion. It is not necessary that you should understand every art, or be proficients in every science; but rest assured, that, as you are successful in one, you might be equally so in all, were you to employ the same degree of attention. Use the utmost diligence and perseverance in that trade or profession in which you are more immediately engaged, and in acquiring what is termed "general knowledge." Never waste the least portion of your time,—seize with ardour on every opportunity of improvement, and press forward with the most determined zeal in all the most useful mechanical, scientific and intellectual pursuits. Remember, you have a *natural genius* for any thing; you are endued with powers of reason and mental faculties capable of achieving the most arduous enterprises and extensive undertakings; and great will be your condemnation if you deceive yourselves with the fallacious opinion, that you were "not born with talents enabling you to perform particular parts in the great drama of life."

SIMON DE MONTFORT.

REVIEW.

SARDANAPALUS, *a Tragedy; the* TWO FOSCARI, *a Tragedy; and* CAIN, *a Mystery.* By LORD BYRON.—London, 8vo. pp. 439.

The noble author of these dramas has long been a successful cultivator of Parnassian flowers, and a favourite with the British public. It cannot be said of him, with any shadow of justice, as of a late nobleman, who was himself no mean favourite of the Muses, "He is a POET among *Lords*," but rather, to his greater praise, "He is a LORD among *Poets*." Often, however, has it been a subject of regret with all the sincere admirers of Lord Byron's wonderful powers, that not only has the subtle and sometimes almost imperceptible poison of bad principles been infused into all his recent and *otherwise* interesting compositions; but his favourite heroes, who are generally desperate characters, have in the most insulting and audacious manner, avowed such demoralizing sentiments and detailed such base and obscene actions, as make us ashamed of our common nature, and ought to call down upon the culpable author the severities of legal chastisement. His respectable publisher seems to have been aware of the risk attached to the act of ushering *all* his productions into the world, and, with regard to *several* of the most obnoxious of them, has refused to become responsible; they have therefore been left, without publisher's aid, to find their way "among natures cognate" in this wicked world, and (it is lamentable to observe!) they have met in certain quarters with a reception much too flattering.

Bu though his Lordship has in this way, more than once, degraded the dignity of his Muse as well as his own reputation, we shall not unite with the miserable dog-whippers who in these degenerate days are to be found on the confines of Parnassus; and who are now attempting to drive the noble poet from those enviable precincts, and to induce a belief that he quaffs no delicious draughts from "the Pierian spring," but, *(horresco referens!)* grossly feeds on *cabbage*, (in the language *scholarum trivialium,)* or, in other words, that he possesses scarcely any of the necessary *inventive* faculties of a true genius, but is eminently a plagiarist. Never was a more unfounded charge, than this, preferred against any of "the gifted race," except it was that of the infamous *Lauder* against MILTON. The result has also in both these monstrous cases been similar: Byron has, like his brother bard, triumphed over the puny and malignant attacks of his virulent assailants, and pursues his course, (would that it were a more virtuous one!) as if nothing adverse had occurred. Lord Byron is opposed to us in sentiment, both on political and religious subjects; yet we cannot with-hold from him the meed of praise which is his due. In one species of poesy he stands without a rival among the moderns, and in others he may, without presumption, expect to wear the victor's wreath upon his lofty brow. To descant on the varied excellences of his style, or to assign him the very place on Parnassus which he is entitled to hold,—is no part of our present purpose. But before we formally introduce to the notice of our readers his last production, we must be allowed to temper the notes of our expressed admiration by the remark, that *we cannot prognosticate long life to his Lordship's verse, as long as it wants the foundation of* VIRTUE, HONOUR, DECENCY and JUSTICE. The rage for vicious poetry is quite ephemeral; and the time is already come, when the licentious airs of ANACREON MOORE are as little in request, as the unchaste and profane madrigals of

ROCHESTER. Before we conclude this Review, it will be a pleasing part of our duty to point out some promising appearances in Lord Byron's present sentiments; and happy shall we be, on some future occasion, to see our most fervent wishes realized in a complete change of his principles and conduct.

We proceed to take the tragedies in the order in which they stand.

I. SARDANAPALUS.

The play opens in a hall of the ancient palace of Nimrod, at Nineveh, where Sardanapalus the king of Assyria meeting Salemenes the brother of Zarina, his consort, dismissed his attendants with orders to prepare his pavilion over the Euphrates, for a midnight banquet, and enters into conversation with Salemenes, who faithfully expostulates with him on his neglecting a virtuous queen for the lewd embraces of Myrrha, an Ionian slave; and discloses to him the dangerous and critical circumstances in which his empire and his person are then placed. Sardanapalus treats the intimations of his brother-in-law very lightly, but is at last, by the united persuasions of Salemenes and Myrrha, induced to confine his revels within the palace walls. Meanwhile Beleses. a Chaldean priest and astrologer, and Arbaces, a military chieftain, are maturing a plan for the subversion of his dominion and the seizure of his person. The two culprits are surprized in the last act of their deliberations, by the faithful and vigilant Salemenes; but Sardanapalus, whose love ol pleasure would not brook the least exercise of cautious reflection, too easily pardons the specious traitors: and while he is in the midst of his evening revels, intelligence is brought of an insurrection headed by the two pardoned malcontents. The voluptuous monarch soon arms himself, though somewhat in military dishabille, and, strutting forth, "makes his first appearance" in the character of a soldier, to repel the aggressions of a lawless mob who assail him within the courts of his palace. During the alternate failures and successes which succeeded, the king has a most affecting interview with his deserted consort, who embarks with thc young princes his sons, to the kingdom of Paphlagonia, which is governed by Cotta their kinsman. Salemenes is at length brought in severely wounded by a javelin broken in his side, which being extracted, he expires. Sardanapalus, after having given one of his attendants the key of the apartment which contains his treasures, with leave to call them all his own, orders a funereal pile to be erected, upon which Myrrha and he place themselves, after the former has set fire to it with a lighted torch.

The noble author has in very few instances deviated from the account given by Diodorus Siculus; and the reader is to "suppose the rebellion to explode and succeed in one day by a sudden conspiracy, instead of the long war of the history."

Part of the introductory speech of Salemenes will convey an accurate description of a voluptuous Eastern Monarch:—

He must be roused. In his effeminate heart
There is a careless courage which corruption
Has not all quench'd, and latent energies,
Repress'd by circumstance, but not destroy'd—
Steep'd, but not drown'd, in deep voluptuousness.
If born a peasant, he had been a man
To have reach'd an empire; to an empire born,
He will bequeath none; nothing but a name,
Which his sons will not prize in heritage:—
Yet, not all lost, even yet he may redeem
His sloth and shame, by only being that
Which he should be, as easily as the thing
He should not be and is. Were it less toil
To sway his nations than consume his life?
To head an army than to rule a harem?
He sweats in palling pleasures, dulls his soul,
And saps his goodly strength, in toils which yield not
Health like the chase, nor glory like the war—
He must be roused. Alas! there is no sound
[*Sound of soft music heard from within.*
To rouse him, short of thunder. Hark! the lute
The lyre, the tymbrel; the lascivious tinklings
Of lulling instruments, the softening voices
Of women, and of beings less than women,
Must chime into the echo of his revel,
While the great king of all we know of earth
Lolls crown'd with roses, and his diadem

Lies negligently by, to be caught up
By the first manly hand which dares to snatch it.
Lo, where they come! already I perceive
The reeking odours of the perfumed trains,
And see the bright gems of the glittering girls,
Who are his comrades and his council, flash
Along the gallery, and, amidst the damsels,
As femininely garbed, and scarce less female,
The grandson of Semiramis, the man-queen.—
He comes! Shall I await him? yes, and front him,
And tell him what all good men tell each other,
Speaking of him and his. They come, the slaves,
Led by the monarch subject to his slaves.

His want of energy and love of pleasure are also well pourtrayed in one of the soliloquies in the same act:—

SARDANAPALUS (*solus*).

Farewell!
He's gone; and on his finger bears my signet,
Which is to him a sceptre. He is stern
As I am heedless; and the slaves deserve
To feel a master. What may be the danger,
I know not:—he hath found it, let him quell it.
Must I consume my life—this little life—
In guarding against all may make it less?
It is not worth so much! It were to die
Before my hour, to live in dread of death,
Tracing revolt: suspecting all about me,
Because they are near; and all who are remote,
Because they are far. But if it should be so—
If they should sweep me off from earth and empire,
Why, what is earth or empire of the earth?
I have loved, and lived, and multiplied my image;
To die is no less natural than those—
Acts of this clay! 'Tis true I have not shed
Blood, as I might have done, in oceans, till
My name became the synonyme of death—
A terror and a trophy. But for this
I feel no penitence; my life is love:
If I must shed blood, it shall be by force.
Till now, no drop from an Assyrian vein
Hath flow'd for me, nor hath the smallest coin
Of Nineveh's vast treasures e'er been lavish'd
On objects which could cost her sons a tear:
If then they hate me, 'tis because I hate not;

If they rebel, it is because I oppress not.
Oh, men! ye must be ruled with scythes not sceptres,
And mow'd down like the grass, else all we reap
Is rank abundance, and a rotten harvest
Of discontents infecting the fair soil,
Making a desert of fertility.

The same features in the character of Sardanapalus are thus tersely related to him by Myrrha:

Oh, monarch, listen—
How many a day and moon thou hast reclined
Within these palace walls in silken dalliance,
And never shown thee to thy people's longing;
Leaving thy subjects' eyes ungratified,
The satraps uncontroll'd, the gods unworshipp'd,
And all things in the anarchy of sloth,
'Till all, save evil, slumber'd through the realm!
And wilt thou not now tarry for a day,
A day which may redeem thee? Wilt thou not
Yield to the few still faithful a few hours,
For them, for thee, for thy past fathers' race,
And for thy sons' inheritance?

The subjoined reflection on the setting of a summer's sun is in the words ot Beleses, one of the chief conspirators:—

The sun goes down: methinks he sets more slowly,
Taking his last look of Assyria's empire.
How red he glares amongst those deepening clouds,
Like the blood he predicts. If not in vain,
Thou sun that sinkest, and ye stars which rise,
I have outwatch'd ye, reading ray by ray
The edicts of your orbs, which make Time tremble
For what he brings the nations, 'tis the furthest
Hour of Assyria's years. And yet how calm!
An earthquake should announce so great a fall—
A summer's sun discloses it. Yon disk,
To the star-read Chaldean, bears upon
Its everlasting page the end of what
Seem'd everlasting; but oh! thou true sun!
The burning oracle of all that live,
As fountain of all life, and symbol of
Him who bestows it, wherefore dost thou limit
Thy lore unto calamity? Why not
Unfold the rise of days more worthy thine
All-glorious burst from ocean? why not dart

A beam of hope athwart the future's years,
As of wrath to its days? Hear me! oh! hear me!
I am thy worshipper, thy priest, thy servant—
I have gazed on thee at thy rise and fall,
And bow'd my head beneath thy mid-day beams,
When my eye dared not meet thee. I have watch'd
For thee, and after thee, and pray'd to thee,
And sacrificed to thee, and read, and fear'd thee,
And ask'd of thee, and thou hast answer'd—but
Only to thus much: while I speak, he sinks—
Is gone—and leaves his beauty, not his knowledge,
To the delighted west, which revels in
Its hues of dying glory. Yet what is
Death, so it be but glorious? 'Tis a sunset;
And mortals may be happy to resemble
The gods but in decay.

The uncertainty which is felt respecting futurity, by the wisest of Heathens, has not been more accurately described by any of the ancient idolaters than it is by one who tries, in this, to be their equal.

SARDANAPALUS.

Yes, and be sermonized,
And dinn'd, and deafen'd with dead men and Baal,
And all Chaldea's starry mysteries.

BELESES.

Monarch! respect them.

SARDANAPALUS.

Oh! for that—I love them;
I love to watch them in the deep blue vault,
And to compare them with my Myrrha's eyes;
I love to see their rays redoubled in
The tremulous silver of Euphrates' wave,
As the light breeze of midnight crisps the broad
And rolling water, sighing through the sedges
Which fringe his banks: but whether they may be
Gods, as some say, or the abodes of gods,
As others hold, or simply lamps of night,
Worlds, or the light of worlds, I know nor care not.
There's something sweet in my uncertainty
I would not change for your Chaldean lore;
Besides, I know of these all clay can know
Of aught above it, or below it—nothing.
I see their brilliancy and feel their beauty—
When they shine on my grave I shall know neither.

BELESES.

For *neither*, sire, say *better*.

The following is a fine picture of a female exerting herself in the battle-throng, for the sake of him who was the object of her affections:—

Know'st thou, my brother, where I lighted on
This minion?

SALEMENES.

Herding with the other females,
Like frighten'd antelopes.

SARDANAPALUS.

No: like the dam
Of the young lion, femininely raging,
(And *femininely* meaneth *furiously*,
Because all passions in excess are female,)
Against the hunter flying with her cub,
She urged on with her voice and gesture, and
Her floating hair and flashing eyes, the soldiers
In the pursuit.

SALEMENES.

Indeed!

SARDANAPALUS.

You see, this night
Made warriors of more than me. I paused
To look upon her, and her kindled cheek;
Her large black eyes, that flash'd through her long hair
As it stream'd o'er her; her blue veins that rose
Along her most transparent brow; her nostril
Dilated from its symmetry; her lips
Apart; her voice that clove through all the din,
As a lute's pierceth through the cymbals' clash,
Jarr'd but not drown'd by the loud brattling; her
Waved arms, more dazzling with their own born whiteness
Than the steel her hand held, which she caught up
From a dead soldier's grasp; all these things made
Her seem unto the troops a prophetess
Of victory, or Victory herself,
Come down to hail us hers.

But to those persons who always and with justice expect to find in the productions of the noble author some strong traces of his personal history, the following affecting scene will communicate hopes of amendment, beyond any thing which he has hitherto expressed. Indeed, no man, except one who had committed a similar offence, could have painted this touching interview between an injured wife and her profligate lord, with such force of nature and truth of colouring. With what a fine and repentant sentiment it concludes! And how truly is depicted the senseless cause of one half of those shameful violations of the marriage vow, when he makes his hero say,

If I was not form'd
To prize a love like thine, a mind like thine,
Nor dote even on thy beauty—as I've doted
On lesser charms, for no cause save that such
Devotion was a duty, and I hated
All that look'd like a chain for me or others
(This even rebellion must avouch); yet hear
These words, perhaps among my last—that none
E'er valued more thy virtues, though he knew not
To profit by them.

But we will not further anticipate the sincere pleasure that will be felt by every well-affectioned and rightly constituted mind, on perusing the whole of these endearing explanations,—into which Sardanapalus, as might naturally be expected, is very reluctant to enter.

SALEMENES.
That
Is all provided, and the galley ready
To drop down the Euphrates; but ere they
Depart, will you not see——
SARDANAPALUS.
My sons? It may
Unman my heart, and the poor boys will weep;
And what can I reply to comfort them,
Save with some hollow hopes, and ill-worn smiles?
You know I cannot feign.
SALEMENES.
But you can feel;
At least, I trust so: in a word, the queen
Requests to see you ere you part—for ever.
SARDANAPALUS.
Unto what end? what purpose? I will grant
Aught—all that she can ask—but such a meeting.
SALEMENES.
You know, or ought to know, enough of women,
Since you have studied them so steadily,
That what they ask in aught that touches on
The heart, is dearer to their feelings or
Their fancy, than the whole external world.

I think, as you do of my sister's wish ;
But 'twas her wish—she is my sister—you
Her husband—will you grant it ?

SARDANAPALUS.

'Twill be useless :
But let her come.

SALEMENES.

I go. [*Exit* SALEMENES.

SARDANAPALUS.

We have lived asunder
Too long to meet again—and *now* to meet !
Have I not cares enow, and pangs enow,
To bear alone, that we must mingle sorrows,
Who have ceased to mingle love ?

Re-enter SALEMENES *and* ZARINA.

SALEMENES.

My sister ! Courage :
Shame not our blood with trembling, but remember
From whence we sprung. The queen is present, sire.

ZARINA.

I pray thee, brother, leave me.

SALEMENES.

Since you ask it.
[*Exit* SALEMENES

ZARINA.

Alone with him ! How many a year has past,
Though we are still so young, since we have met,
Which I have worn in widowhood of heart.
He loved me not : yet he seems little changed—
Changed to me only—would the change were mutual !
He speaks not—scarce regards me—not a word—
Nor look—yet he *was* soft of voice and aspect,
Indifferent, not austere. My lord !

SARDANAPALUS.

Zarina !

ZARINA.

No, *not* Zarina—do not say Zarina.
That tone—that word—annihilate long years,
And things which make them longer.

SARDANAPALUS.

'Tis too late
To think of these past dreams. Let's not reproach—
That is, reproach me not—for the *last* time——

ZARINA.

And *first*. I ne'er reproach'd you.

SARDANAPALUS.

'Tis most true ;
And that reproof comes heavier on my heart

Than——But our hearts are not in our own power.

ZARINA.

Nor hands; but I gave both.

SARDANAPALUS.

Your brother said,
It was your will to see me, ere you went
From Nineveh with ——(*He hesitates.*)

ZARINA.

Our children: it is true.
I wish'd to thank you that you have not divided
My heart from all that's left it now to love—
Those who are your's and mine, who look like you,
And look upon me as you look'd upon me
Once——But they have not changed.

SARDANAPALUS.

Nor ever will.
I fain would have them dutiful.

ZARINA.

I cherish
Those infants, not alone from the blind love
Of a fond mother, but as a fond woman.
They are now the only tie between us.

SARDANAPALUS.

Deem not
I have not done you justice: rather make them
Resemble your own line, than their own sire.
I trust them with you,—to you: fit them for
A throne, or, if that be denied——You have heard
Of this night's tumults?

ZARINA.

I had half forgotten,
And could have welcomed any grief, save yours,
Which gave me to behold your face again.

SARDANAPALUS.

The throne—I say it not in fear—but 'tis
In peril; they perhaps may never mount it.
But let them not for this lose sight of it.
I will dare all things to bequeath it them;
But if I fail, then they must win it back
Bravely—and, won, wear it wisely not as I
Have wasted down my royalty.

ZARINA.

They ne'er
Shall know from me of aught but what may honour
Their father's memory.

SARDANAPALUS.

Rather let them hear
The truth from you than from a trampling world.
If they be in adversity, they'll learn
Too soon the scorn of crowds for crownless princes,
And find that all their father's sins are theirs.
My boys!—I could have borne it were I childless.

ZARINA.

Oh! do not say so—do not poison all
My peace left, by unwishing that thou wert
A father. If thou conquerest, they shail reign,
And honour him who saved the realm for them,
So little cared for as his own; and if——

SARDANAPALUS.

'Tis lost, all earth will cry out, Thank your father!
And they will swell the echo with a curse.

ZARINA.

That they shall never do; but rather honour
The name of him, who, dying like a king,
In his last hours did more for his own memory,
Than many monarchs in a length of days,
Which date the flight of time, but make no annals.

.SARDANAPALUS.

Our annals draw perchance unto their close;
But at the least, whate'er the past, their end
Shall be like their beginning—memorable.

ZARINA.

Yet, be not rash—be careful of your life,
Live but for those who love.

SARDANAPALUS.

And who are they?
A slave, who loves from passion—I'll not say
Ambition—she has seen thrones shake, and loves;
A few friends, who have revell'd till we are
As one, for they are nothing if I fall;
A brother I have injured—children whom
I have neglected, and a spouse——

ZARINA.

Who loves.

SARDANPALUS.

And pardons?

ZARINA

I have never thought of this,
And cannot pardon till I have condemn'd.

SARDANAPALUS.

My wife!

ZARINA.

Now blessings on thee for that word!
I never thought to hear it more—from thee.

SARDANAPALUS.

Oh! thou wilt hear it from my subjects. Yes—
These slaves, whom I have nurtured, pamper'd, fed,
And swoln with peace, and gorged with plenty, till
They reign themselves—all monarchs in their mansions—
Now swarm forth in rebellion, and demand
His death, who made their lives a jubilee;
While the few upon whom I have no claim
Are faithful! This is true, yet monstrous.

ZARINA.

'Tis
Perhaps too natural; for benefits
Turn poison in bad minds.

SARDANAPALUS.

And good ones make
Good out of evil: Happpier than the bee,
Which hives not but from wholesome flowers.

ZARINA.

Then reap
The honey, nor inquire whence 'tis derived.
Be satisfied—you are not all abandon'd.

SARDANAPALUS.

My life insures me that. How long, bethink you,
Were not I yet a king, should I be mortal;
That is, where mortals *are*, not where they must be?

ZARINA.

I know not. But yet live for my—that is,
Your children's sake!

SARDANAPALUS.

My gentle, wrong'd Zarina!
I am the very slave of circumstance
And impulse—borne away with every breath!
Misplaced upon the throne—misplaced in life.
I know not what I could have been, but feel
I am not what I should be—let it end.
But take this with thee: if I was not form'd
To prize a love like thine, a mind like thine,
Nor dote even on thy beauty—as I've doted
On lesser charms, for no cause save that such
Devotion was a duty, and I hated
All that look'd like a chain for me or others
(This even rebellion must avouch); yet hear
These words, perhaps among my last—that none
E'er valued more thy virtues, though he knew not
To profit by them—as the miner lights
Upon a vein of virgin ore, discovering
That which avails him nothing: he hath found it,

But 'tis not his—but some superior's, who
Placed him to dig, but not divide the wealth
Which sparkles at his feet; nor dare he lift
Nor poise it, but must grovel on upturning
The sullen earth.

ZARINA.

Oh! if thou hast at length
Discover'd that my love is worth esteem,
I ask no more—but let us hence together,
And *I*—let me say *we*—shall yet be happy.
Assyria is not all the earth—we'll find
A world out of our own—and be more blest
Than I have ever been, or thou, with all
An empire to indulge thee.

Enter SALEMENES.

SALEMENES.

I must part ye—
The moments, which must not be lost, are passing.

ZARINA.

Inhuman brother! wilt thou thus weigh out
Instants so high and blest?

SALEMENES.

Blest!

ZARINA.

He hath been
So gentle with me, that I cannot think
Of quitting.

SALEMENES.

So—this feminine farewell
Ends as such partings end, in *no* departure.
I thought as much, and yielded against all
My better bodings. But it must not be.

ZARINA.

Not be?

SALEMENES.

Remain, and perish——

ZARINA.

With my husband——

SALEMENES.

And children.

ZARINA.

Alas!

SALEMENES.

Hear me, sister, like
My sister:—all's prepared to make your safety
Certain, and of the boys too, our last hopes.
'Tis not a single question of mere feeling,
Though that were much—but 'tis a point of state:
The rebels would do more to seize upon
The offspring of their sovereign, and so crush——

ZARINA.

Ah! do not name it.

SALEMENES.

Well, then, mark me: when
They are safe beyond the Median's grasp, the rebels
Have miss'd their chief aim—the extinction of
The line of Nimrod. Though the present king
Fall, his sons live for victory and vengeance.

ZARINA.

But could not I remain, alone?

SALEMENES.

What! leave
Your children, with two parents and yet orphans—
In a strange land—so young, so distant?

ZARINA.

No—
My heart will break.

SALEMENES.

Now you know all—decide.

SARDANAPALUS.

Zarina, he hath spoken well, and we
Must yield awhile to this necessity.
Remaining here, you may lose all; departing,
You save the better part of what is left
To both of us, and to such loyal hearts
As yet beat in these kingdoms.

SALEMENES.

The time presses.

SARDANAPALUS.

Go, then. If e'er we meet again, perhaps
I may be worthier of you—and, if not
Remember that my faults, though not atoned for,
Are *ended*. Yet, I dread thy nature will
Grieve more above the blighted name and ashes
Which once were mightiest in Assyria—than——
But I grow womanish again, and must not;
I must learn sternness now. My sins have all
Been of the softer order——*hide* thy tears—
I do not bid thee *not* to shed them—'twere
Easier to stop Euphrates as its source
Than one tear of a true and tender heart—
But let me not behold them; they unman me
Here when I had remann'd myself. My brother,
Lead her away.

ZARINA.

Oh, God! I never shall
Behold him more!

SALEMENES (*striving to conduct her*).

Nay, sister, I *must* be obey'd.

ZARINA.

I must remain—away! you shall not hold me.
What! shall he die alone?—*I* live alone?

SALEMENES.

He shall *not die alone;* but lonely you
Have lived for years.

ZARINA.

That's false! I knew *he* lived,
And lived upon his image—let me go!

SALEMENES *(conducting her off the stage)*.
Nay, then, I must use some fraternal force,
Which you will pardon.

ZARINA.
Never. Help me! Oh!
Sardanapalus, wilt thou thus behold me
Torn from thee?

SALEMENES.
Nay—then all is lost again,
If that this moment is not gain'd.

ZARINA.
My brain turns—
My eyes fail—where is he? [*She faints.*

SARDANAPALUS *(advancing)*
No—set her down—
She's dead—and you have slain her.

SALEMENES.
'Tis the mere
Faintness of o'er-wrought passion: in the air
She will recover. Pray, keep back.—[*Aside.*] I must
Avail myself of this sole moment to
Bear her to where her children are embark'd,
I' the royal galley on the river.
[SALEMENES *bears her off.*

SARDANAPALUS *(solus)*.
This, too—
And this too must I suffer—I, who never
Inflicted purposely on human hearts
A voluntary pang! But that is false—
She loved me, and I loved her. Fatal passion!
Why dost thou not expire *at once* in hearts
Which thou hast lighted up at once? Zarina!
I must pay dearly for the desolation
Now brought upon thee. Had I never loved
But thee, I should have been an unopposed
Monarch of honouring nations. To what gulphs
A single deviation from the track
Of human duties leads even those who claim
The homage of mankind as their born due,
And find it, till they forfeit it themselves!

One extract more we could have wished to make; but having given this connubial parting scene at full length, we cannot indulge in further quotations. Enough has been produced to shew, that SARDANAPALUS is an excellent closet tragedy, exhibiting the vast talents of the author and his diversified powers of description. Acrimonious persons may surmise, that it abounds with some strong allusions to Lord Byron's recorded opinions both on politics and religion: In our opinion, however, it does not display any particular bias of that kind, and not so much as we have seen in the productions of other dramatic writers. If rdanapalus be an Epicurean and an Atheist, and, in the midst of his revels, occasionally spout out the revolting articles of his brief creed,—and if Beleses can bend his religious system to countenance rebellion and apostacy,—both of them act perfectly in character as HEATHENS; but, we hope, they will not in these respects become examples for the imitation of CHRISTIANS.

But we entertain old-fashioned prejudices against the introduction of such personages as Myrrha, though she be the favourite concubine of an Eastern Monarch. It is in relation to her, that Sardanapalus is made to say, what it has lately been a part of our infelicity often to hear,

> "But our hearts are not in our own power."

We are aware, that, in another part of the same dialogue, the King himself refutes this sentiment; yet its pernicious tendency is not destroyed by his frank acknowledgment. The conversations between him and Myrrha are also of such a nature, as to prevent us from recommending the work to the perusal of young people. To us it seems no extenuation to aver, that "other writers have on this point sinned still more grievously." We view all palliations of vicious conduct as couvert crimes against the best interests of mankind, and not to be passed over with a slight degree of reprehension. But some dramatic moralist will perhaps tell us, that "Lord Byron has acted nobly in punishing the adulterer and his slave, by making them the victims who are destroyed together on the blazing pyre." If this answer suit his shallow purpose, he is welcome to all the personal benefit of it,—though we are inclined to think the author would not thank him for such a supposed improvement; but the suggestion does not remove our conscientious scruples, which are equally strong against all similar exhibitions of connubial infidelity and lawless concubinage bedizened with the assumed ornaments of true affection. *(To be continued.)*

THE NOBILITY OF ENGLAND.

In no kingdom on the continent of Europe has the dignity of the several orders of nobility been so judiciously preserved, or the rights of inheritance so well regulated, as in England. The British constitution has, with the exception of a small body of hereditary Councillors, wisely confounded the Baronage with the common people. It is by no means improbable that there exist in England thousands of Howards, Russels, and Talbots; but the rank of a Peer is solely the property of those who are by birth-right the constituted Representatives of those families; and no one else is permitted to claim, or even thinks of claiming, any manner of distinction on the ground of his distant connection with the parent stock, or bearing a name that exactly corresponds with those flourishing branches. There are also hundreds of Campbells resident in London and in the metropolis of Scotland, who can trace with equal facility and truth their lineal descent from the same noble ancestors as the Duke of Argyle; yet their names obtain for them no greater distinction than may be attached to the descendants of the humblest individuals; and many of them assist to form a part of that undistinguished throng whose avocations are of the most laborious and unassuming description.—But on the Continent nothing would be wanting to make these men nobles, except the establishment and clear deduction of their genealogy; on the strength of which,—though poor, ignorant, and contemptible in the very last degree,—they might constitutionally claim a superiority over the most meritorious citizens of an inferior descent. In consequence of this almost unlimited privilege, the continent is swarming with idle and evil-disposed men, who prefer the rank of Nobility,—though sustained by the cant of a mendicant, by the artifices of a sharper, or the rapier of a ruffian,—to the respectability of an honest trader, because, when they have once entered on the path of commerce, they can no longer retain *caste*. The Russian empire is said to contain 580,000 nobles; that of Austria on a late enumeration contained 238,000 male nobles; and the kingdom of Spain, in 1785, contained 479,650. In France this abuse was abolished by the Revolution; but on the return of the Bourbons to the throne, many thousand individuals were introduced into that kingdom who separate themselves from their fellow-citizens, and, by the pretensions of their birth, lay claim to every kind of privilege.

It is impossible for such a state of things as that to be of long duration in a country, in which knowledge has made any advance; for the voice of the public, loudly exclaiming against it, is now heard to re-echo from the extremities of Europe. The ground of this distinction on the Continent is so foolish and absurd, that it will not bear to be inquired into; and the foundation of an hereditary and more limited Peerage, is the only method of saving the Noblesse of those countries from sinking into perfect insignificance. Those who constitute the ranks of nobility are in many countries accounted the least estimable part of society, when considered in connection with the common weal. The meanest mechanic, as well as the respectable tradesman, and the man of commerce with the member of the genteel professions, conduce severally in their different degrees to national prosperity; while the nobility are left as a sort of hereditary spectators of the scene, and frown or smile, despise or encourage, retard or promote, the various objects pursued by the useful grades of society, according as nature has included or forgotten in their composition a spirit of patriotism and an ardent desire for the mental exaltation and superiority of their countrymen in every department of art and science. Ranks and degrees among men are obviously beneficial, when properly preserved and exercised; and those who have, in the bountiful dispensations of heaven, been invested with titles of nobility, are entitled to the respect and obeisance of their inferiors. But to the eye of reason, the distinction will always appear only a nominal one; and those who possess it may most effectually secure the respect of their cotemporaries, by displaying that true nobility of mind which distinguished many of their ancestors. True greatness consists in affording the example of a virtuous course of life, and in per-forming meritorious actions; and wherever a consistent uniformity of noble conduct and good behaviour is not necessary to distinction, it is natural that the external badges of such distinction should not be much in request.

It is an observation of the great Mr. Burke, that the only part of the French army which was good at the time of the Revolution, was the Artillery; and that, because the officers of the corps were generally selected from the people.

"There exists in England," observes Mr. Coleridge, "a 'gentlemanly' character, a gentlemanly feeling, unexampled in the rest of Europe, which probably originated in the fortunate circumstance, that the titles of our English Nobility follow the law of their property, and are inherited by the eldest son only. From this source, under the influence of our Constitution, and of our astonishing trade, it has diffused itself in different modifications through the whole country. The uniformity of our dress among all classes above that of the day-labourer, while it has authorised all classes to assume the appearance of Gentlemen, has, at the same time, inspired the wish to conform their manners, and still more their ordinary actions in social intercourse, to their notions of a Gentleman."

In England a BRINDLEY, a PEEL, an ARKWRIGHT, a WEDGWOOD, a RENNIE, or any other man whose talents and application have raised him to eminence in his profession, even though he had received no title, is elevated to an equality with any other gentleman. Nor should we, on the other hand, think it a reproach to any man of rank, that he had added to his substance by improving the manufactures of his own country or those of any other. But in Hanover, a poor man of the Order of Noblesse, having a large family, recently sent one of them to a compting-house in Hamburgh, and was absolutely degraded from his rank for an innovation, which, as it was said, "reflected indelible disgrace upon the Order!" How unnatural and injurious are such opinions as these!

SIMPLICITAS.

ANECDOTES.

The subjoined nine anecdotes are selected from a new and entertaining work, somewhat quaint in its title, which runs thus,—*Paramythia, or Mental Pastimes, being original Anecdotes, historical, descriptive, humourous aud witty; collected chiefly during a long residence at the Court of Russia.*—The author is an artist, who superintended the publication of *the Russian Costumes,* and had frequent and favourable opportunities of observing the manners and customs of the half-civilized natives of Russia, of which he has availed himself with advantage. The whole of the volume is not occupied on Russian affairs; the author is a *citizen of the world,* and has, with some exceptions, looked on his fellow beings with an eye of feeling. He introduces each anecdote with a few short remarks, which, as our readers will perceive, are often distinguished for the acumen and good sense which they exhibit.

I. WANT OF EDUCATION.

That the want of education is greatly to be regretted, few will deny. I trust, however, this misfortune will not be much longer to be lamented. Rapid strides are making towards a system of general instruction throughout all Europe; and I will boldly assert my conviction, that the youth of both sexes, are even now, better educated, and fonder of reading, than they were forty years ago: then books were seldom opened, particularly new ones; whereas now, young people seem ashamed if they are not able to give some opinion on any new publication deserving notice; to say nothing of the general information and political knowledge diffused by the daily journals, magazines, and other periodical works, constantly issuing from the press.

A German of the name of Klotch, a very worthy man, was cook and maître d'hotel to the Empress Catherine. Though old, he was a court beau, and very spruce about the head; and, being a favourite with her imperial majesty, used to hand some particular dishes to her on great occasions. Though able to please the palates of all his friends, and admitted into very respectable society, he had, unfortunately, finished his studies rather in the kitchen than the library, and could not read. His intimate friend, a court jeweller, who had, like him, studied the setting of precious stones with more application than the setting of types, also could not read, at least manuscript. This misfortune, though known to most of their friends, was not acknowledged by either; and they were appointed, rather maliciously, to deliver as stewards, the invitations to a great ball and supper. They seated themselves in their carriage, with their hands full of cards; the coachman's enquiry of where he should drive was a thunder-bolt to each; our friend, the cook, to ease his embarrassment, said he had forgot his spectacles. The jeweller had his on! Still it would not do. They stared at each other, then at the superscriptions, but all in vain—the coachman still looking round for orders. At last, each finding out the other's secret, they shook hands, swore eternal friendship; and very philosophically concluded, though learning was an excellent thing, a court cook and court jeweller might pass through this best of all possible worlds tolerably happy without it.

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II. GOOD-NATURE OF SAILORS.

I have always thought sailors the most modest and diffident men in the universe; I wish some one would point out the reason. They are decidedly favourites, are always well received, awaken a greater interest than landsmen, by their absence, and the dangers they are exposed to; come in contact with a greater variety of people, and therefore ought to have more confidence. Whereas the manufacturer, or mechanic, lives usually in a small town or village, sees only his employers, and his few friends; has only to do a certain thing every day, and that for so many hours, that it precludes every other thought, (or rather prevents thinking at all,) and yet they are generally confident, often pert, and even occasionally impudent. The sailor sees the world, and though he may not think much, is an improved man. Look at what he can do, compared with the manufacturer or mechanic; he can turn fisherman, waterman, sail-maker, rigger, rope-maker, painter, caulker, and often tailor or shoemaker; is as capable, and certainly more handy, as a labourer, than most landsmen; independant of his own duty as an able-bodied seaman, to hand, reef, and steer. If, in addition to all this, he is at all educated, he may become any thing. It would be worth while to enquire whether the greater part of our prosperous men are not descended from sailors, who frequently turn merchants, brokers, &c. &c., and yet they are certainly the most modest unassuming mortals breathing.

A captain of a merchant-ship was dining at his merchant's table with a large party. It is the custom at St. Petersburg to carve the poultry, or cut a great many slices of the roast or boiled meat, and send it round by a servant to the company, each helping himself to the part he likes, or as much as he chooses. A duck had been carved, and put, as it so happened, into a plate to be handed round. As the lady of the house had often observed the diffident character of our British tars, she verified the proverb, that "those that humble themselves shall be exalted," and placed our country's defender at her right hand, at the top of the table. It followed, the plate of duck was first handed to him; he took the whole, without returning his own plate, eyed it, blushed, wiped his forehead, wriggled in his chair, admitted, in a hectic stammering voice, he was not a bad trencher-man, but protested that madam was very bountiful; said that he would just try what he could do, and actually ate it all, (to the no small astonishment of all present,) merely for want of sufficient confidence to correct an error once made.

III. EMBARRASSMENT.

That low and vulgar people should feel embarrassed before their superiors, surrounded by all the imposing paraphernalia of dress, state, and splendour, is not astonishing; but that those whose education is intended to fit them for the most trying of pnblic situations, that of an ambassador, should suffer the same embarrassment, is more to be wondered at, and difficult to explain. Does it arise from too much or too little preparation for the occasion? Perhaps from both. When the passions are much moved, and our happiness at stake, as in the affairs of love and marriage, I can easily conceive a match of interest much more coolly discussed, than when the affections are deeply engaged, for this will naturally produce embarrassment. But, in the ordinany routine of life, it is inexplicable; and we often see the most enlightened, of both sexes, the greatest martyrs to this unaccountable sensation or weakness.

Such is the awe that dignified majesty impresses on the beholders, and so peculiarly eminent was it in the striking manners and deportment of her imperial majesty, the Empress Catherine, that even a Frenchman was overcome by it. The Count de —— was appointed ambassador by the court of Versailles to that of St. Petersburg: on the day of his audience and presentation, the empress was seated on a splendid throne in the marble hall, surrounded by the imperial family, the chevalier guard in silver armour, her generals, admirals, great officers of state, and of the court; foreign ministers, ladies of rank, and other distinguished characters, &c. &c. The Count de —— entered the saloon, but was so completely astonished and overawed by the magnificence of the scene, that, instead of delivering the speech he had studied, he could only kneel down at the foot of the throne, and stammer out, "*Le roi, mon maitre,—Le roi, mon maitre,*" and could absolutely get no farther. The empress, pitying his confusion and distress, rose with her accustomed obliging affability, and said, "My dear Count—The king your master, feeling the most friendly disposition towards me and my empire, and wishing me all the happiness this world can bestow, has honoured you with the appointment of his ambassador so to tell me." Then stepping from the throne with the utmost grace and ease, gave him her hand to kiss, and walked out of the hall.

IV. NATIONAL GENEROSITY AND PRIDE.

National pride may be useful. I think it is. The French have their share of it, and whatever may be the rank in society of the possessor, no pains are taken to hide it. We have it often to excess. But, as the truly well-bred English gentleman will veil it as much as possible, so there is a style of low, boisterous, prejudiced, self-sufficient vulgarity, in which I fear a few of my worthy countrymen are really unrivalled, particularly when they are abroad.

In the autumn of 1792, I was travelling from Russia to England through Germany, and, arriving at Mayence, found the town and hotels full of French emigrants; indeed so full that about thirty sat down to dinner at the house where we were: all, but myself and travelling companion, French. As we were only two, they, with their well-known national politeness, insisted upon our taking the post of honour; and placed us at the head of the table, on each side a most venerable white-headed old French nobleman, with the rank of General in the French service, who presided. The conversation turned on their misfortunes and personal distress, and from that naturally to the revolution. The old gentleman, with tears in his eyes, lamented the horrors of revolutionary France; said he had had the misfortune to lose two sons, killed in America, and that he was then going with his third and only one, a fine young man to whom he pointed, to join the royal cause, where the same melancholy fate might await him also. He went on, and added, he thought Pitt so great a patriot, and so profound a statesman, (complimenting me by saying, he thought it an honour to any man to be born his countryman,) that he felt it impossible so great a man should sit still, and not attempt to prevent the miseries the mistaken revolutionary principles of egalité and stuff, would entail on misguided Europe. I was a staunch Pittite, fell in with his views of affairs, and said so much in favour of "the pilot that weathered the storm," that it awakened the indignation of one of our republican bucks, in the shape of a yellow-topped booted manufacturing kiddy traveller, who had joined the table d'hôte towards the latter end of the dinner. He rose up, and, squaring his elbows in the true Mendoza style, called out loudly to me, "* * * *, sir! If I do not think you are one of his sneaking pensioners, and paid for praising him." Attacked in so rude and unqualified a way, I rose up, and was about to reply and resent it; when the old officer pulled me gently down again on my chair, "*Laissez-moi faire,*" said he; and then, in the most dignified manner, and in perfect good English, lectured the youth on the rudeness and vulgarity of his behaviour to a stranger, adding his conviction, that not one of the company present would exchange another word with him. He was thus completely voted to Coventry, while we remained quietly taking our wine and coffee. Finding he had got into the wrong box, and that he had made his situation too hot to hold, he sneaked out of the room, and either changed his hotel, or pursued his journey, for we saw no more of him.

V. PRESENCE OF MIND AND FRANKNESS.

The more people are surrounded by the delicacies and conveniences of life, the more they are the slaves of form and etiquette. It is on this account, among others, that travelling is often of so much use. The rubs, scrubs, and incidental privations, and the different habits and manners of other countries, enable us to appreciate properly what ought to content us in our own. The same lady that would catch cold if her *femme de chambre* neglected to get ready the thinnest of the thin part of her dress, or would be qualmish if the slightest accident happened to derange the feast at home, would eat sour crout and sausages in Germany, frogs in France, oily fish-soup in Russia, or the rump-steak of a horse in Tartary, with appetite; and smile on her return home, to see the distress of her friends at being caught under the horror of a cold dinner, or in a dress of the last year's fashion.

What would the unceremonious, easy, frank, and artless inhabitants of such places as the rural, cottage-like, rustic vale of Clapham Common, Battersea-Rise, and similar unadorned sylvan scenes do, in the predicament I once found myself, when the accomplished Princess Galitzen and the two Countesses Protassoff, her youngest sisters, equally amiable and rich in those graces that a good education and the polish of a court never fail to give, drove up to my door in a splendid equipage with six horses, two fore-riders, two hussars, and a court laquais in full livery! Imagine her tripping up stairs with perfect ease and freedom, to tell me she could not resist her sisters' repeated wishes to come and take an English family dinner with me. Delighted I really was, but not so my poor spouse! the whole house was in a quandary. I knew but too well our humble bill of fare for the day; and stole out, in a few minutes, to assist in the awful conference. It was carried, *nem. con.*, that fish might be had in half an hour, and that a chicken might be broiled in less time, and look pretty; but what to do for something characteristic and *English* we did not know, and were *au desespoir*. At last I wrote a note to a neighbour, explaining our deplorable situation; and never was more enchanted than when I found the servant had returned, loaded with a most famous cold round of beef, with, however, strong injunctions that it should be immediately returned after dinner, they having a large party in the evening, when many, many, sandwiches would be wanted. I felt proud when we sat down to dinner: it was nicely pickled, looked enchantingly red and white, and was deservedly admired. Our visitors did justice to our national dish, and all went on velvet. We took our coffee, chatted, drank tea, had a little music; but judge of my petrified condition, when the carriage came, to hear it ordered to go back, and return at twelve; the princess declaring she must have another slice of that most excellent beef at supper! You might have knocked my wife down with a straw, and my daughter could play no more English tunes. I saw their distress, and, judging it best to make a virtue of necessity, whispered the story to the princess, who entering into the spirit of it, we boldly sent again for the beef; and, as we were only a few doors apart, it furnished no small amusement to see the velocity with which the better part of the ox travelled backwards and forwards, certainly faster than ever it had done when in the possession of its original owner. In short, it was one of the most embarrassing yet merriest days I ever passed in my life.

VI. THE EFFECTS OF IMPATIENCE.

That patience is a virtue, is generally admitted: that it is often not so considered, (particularly by the young and hasty,) is to be lamented. In travelling, a good stock of it is one of the most useful articles you can pack up. It is often put to the severest trials on the continent, where the roads are not so good, the relays of horses not so ready, or the post-masters, who have no competition to fight against, not so alert; and, by sea, the winds are not to be bribed or controlled. The want of it is occasionally very properly punished, as will be illustrated in the following anecdote.

On one of my journeys from Russia with a friend of mine, many years past, when we were young and impetuous, we took our passage in a ship at Cronstadt, which, though a good one, and commanded by a most excellent and obliging sailor, did not prevent us from having what they technically call a beating passage; in fact, we had nothing but contrary winds and heavy gales to contend with, so that we were a month in reaching Elsinore. Our patience was exhausted, and, thinking we should never see England, we left the ship, and went back to Copenhagen, intending to go by the packet to Keil, a short distance, and from thence to Hamburgh; take our passage to Harwich, and so insure our certain arrival in England. We had to wait a week at Copenhagen for a fair wind to Keil; and here I must take occasion to thank and praise the hospitality of the Danes; for though we were without letters of introduction, we were admitted to their excellent club, and were entertained very handsomely at several of the respectable merchants' houses. At last the packet sailed full of passengers; the weather so desperate that we lost one washed overboard; split our main sail, and the vessel became so unmanageable, that the master became confused, took to the bottle, and got drunk; in short we expected to be lost every minute. A very intelligent gentleman, a Dane, who spoke English, finding that our worthy captain had tapped his last case-bottle, containing at least six quarts, advised me to beg a drop of it, and, taking advantage of the motion of the ship, to let it fall and break it. I did so; and I must to his credit say, that, when he got sober, he thanked me for what I had done, and begged on our arrival, four days afterwards, that I would say nothing of his weakness at the post-office. We then had to travel by land, in an open post-waggon, without springs, and over bad roads, in a rainy November, to Hambro'. Here we again had to wait a week for the packet sailing; had a tedious passage to Harwich; and arrived in London, after all our expense and unnecessary fatigue, time enough to see the ship we had left at Elsinore ready to sail on a new voyage. She had, on our leaving her, sailed with a fair wind, and reached the Thames in four days, delivered her cargo, and taken in another. We saw the captain on 'Change, who laughed heartily at our expense, and who, having, as most sailors have done, dipped occasionally into Shakspeare's volumes, treated us with its being "better to endure the ills we have, than fly to others that we know not of;" and added, after his poetic flight, "It is a long lane that has no turning."

VII. DIFFERENCE IN NATIONAL HABITS.

Happiness does not depend so much on the contents of the plate-glass windowed shops on Ludgate Hill, or the well-fed and well-grown delicacies of Leadenhall Market, as many suppose. Where little is to be had, and that in no great variety, the mind is soon satisfied. Necessity dictates, and habit confirms. In this country the rich have perhaps too great a share of personal indulgences, and the poor too little. It might better the condition of the latter, and afford them a greater variety of food, if, like the foreigners, they adopted a more general use of ovens. Buckwheat and other grain might be made into puddings, and fish, flesh, and fruit, into pies. The parish might appropriate a part of the money they advance to supply them with gear for these purposes. I think the experiment worth trying.

The hints suggested in the foregoing introduction are further illustrated by the habits of the Swedes, and their neighbours the Russians. Though both countries, being woody, abound with berries and mushrooms, the Swedes scracely eat them; while the Russians, who have no want of provisions, almost live upon them during their fast, and use them generally. The leaving Russia, and entering Swedish Finland, is like leaving a plentiful market to take up with the scanty variety of a little chandler's shop. Even the state of society is so different between Petersburg and Stockholm, that we left Count S——, the Swedish ambassador, living in a grand hotel as large as a palace, and driving with six horses, two fore-riders, and two hussars, and a servant in a splendid livery behind his carriage; and saw his brother, the lord high admiral of Sweden, driving in a buggy in the streets of Stockholm, with a slovenly boy standing on a leather strap behind the dignified vehicle; and we dined with the English charge d'affaires on a few very indifferent lake-fish, and a little half-starved scraggy fillet of tough veal, which he assured us was the envy of every one who saw it carried through the streets. This is little to be wondered at, when the reader is informed they bake but once a year the blackest of black bread, for common use, which takes hours to nibble, it is so hard—and that the ladies dip their own candles; yet they are accomplished and well-informed, dance delightfully, sing and play with taste, are hospitable, frank, and well-bred; look as smart and handsome, and seem as happy, as any nation under the sun; at least I had no reason to think otherwise, during my journey through that country.

VIII. THE OBSERVANCE OF ETIQUETTE.

There are some folks not to be drilled, persuaded, or even thumpt into good-breeding, and the observance of the common received forms of society. I think such had better be treated as I have sometimes seen a country fellow treat an obstinate calf or pig,—drive him the wrong way, that he may go the right. Tell any loquacious person you have reason to fear will commit himself, to talk and chatter away, for he is very amusing and clever, and ten to one you keep him silent more effectually, than if you were to beg it as a favour; he would condescend to be amused in any society superior to him in wit, judgment, or information. Such is the perverseness of human nature, and more particularly the error of women than men. Oh! that some I have seen, who were virtuous wives, kind and good mothers, prudent and careful housekeepers, had but had the good sense to have held their tongues, when lifted, by the success of their husbands, into situations their early expectations in life never could lead them to expect! How many domestic broils would they have avoided, and how much they would have been esteemed by their husbands, children and all around them! Pardon me, ye sweet partners of social life; ye, whose soft endearments form the solace, comfort, and happiness, of labouring, afflicted, troubled man, in this best of all possible worlds; pardon this single twig of birch; it shall be tied up with any coloured ribband you choose to select, so that ye promise it need never more be used.

When Baron Dimsdale was about to leave Russia, after having, with so much success, introduced the blessing of inôculation throughout that extensive empire, her majesty, the Empress Catherine, so nobly setting the glorious example in her own person, by daring to undergo the operation, which was successfully performed by the baron, who, for that, acquired his title and an ample fortune. His wife, grateful for the favours bestowed on him by the empress, naturally became desirous to see her majesty, and pour out her acknowledgments before her. This (as I have heard) was somewhat opposed by the baron, he knowing the baroness was more to be admired for the warmth of her honest feelings, than her knowledge of the graces, etiquette, and forms of a court. She was not, however, to be denied; and the empress, being apprised of her wishes, appointed a day to receive her ladyship, The lady went; the baron, in fear and trembling, accompanied her; and as he feared, so it fell out. The gratitude of his honoured spouse so far got the better of her good breeding, that, when her majesty entered the saloon, instead of half kneeling to kiss the hand held out with so much grace, she flew towards her like a tiger, and almost smothered the poor empress with hugging and kissing. As soon as the suffering sovereign could disengage herself, and shake her feathers, after so rude and boisterous an embrace, she walked on smiling, and told the baron, that " Your wife is truly amiable;" and to her attendants she very coolly said, " Such things will occasionally happen."

IX. BRAVERY APPRECIATED IN A YOUNG SAILOR.

I hope the gentlemen of the army will not be offended with my seeming predilection to sailors. The truth is, that through life I have been in the constant habit of associating with them, and have had but little, if any, intercourse with soldiers. It would be superfluous for me to declare my conviction, that, had I been at all on terms of intimacy with them, I should have had to record as many instances of heroism, presence of mind, discrimination, courage, hardihood, and generous feelings, in the military ornaments and defenders of their country, as in its naval heroes.

When I was a boy, I had for a playmate the son of a captain of a ship, who was bringing him up for the sea, and during the holidays we were much together. One fine afternoon we took courage, went to the waterside, and borrowed a skiff of a coal-merchant, who served both our families with coals. We were the happiest boys in existence; we rowed, we feathered our skulls, and we blistered our hands; till, being exhausted, hot, and completely tired, we resolved to return home. We pulled away lustily, and, when near the shore, the boat having what is technically called good head-way, we took in our oars, and were grinning with delight to see how well she would land us, but unfortunately my companion, in his ecstacy, had his hand on the boat's gunwale, which, coming in contact with another boat, tore off his little finger, so that it hung by a small portion of skin. It did not bleed much, nor did he seem to suffer much pain, at least he did not roar and bellow. We did as servant-maids usually do when they have broken a tea-cup or saucer, put the pieces together repeatedly, and with exactly the same success, for they would neither join nor stick. An old waterman, who was an eye-witness to our distress, tied his hand up carefully with one of our handkerchiefs, and told him to go home immediately, and have it taken care of. We did go home, sorrowing, he expecting, in addition to the loss of his finger, to be well beaten. When arrived, we skulked in, and found neither his father nor mother at home: they were out walking with the other children. Curiosity led us to untie the hand, in doing which the skin broke and separated the finger completely; which he laid on the chimney-piece, again tied up the hand, and (still fearful of a good banging) went into a field behind the house, and loitered about. His parents soon returned, and the mother's eye glancing round the room to see that all was right, soon espied the finger: so odd a circumstance petrified her, and she became sick with apprehension. The father, being more cool, said it was a boy's; and, as all the family were present except poor Jack, "Where is he?" was the general cry. "Oh, I see him with Jem. W." said one of his sisters. We were called, interrogated, and the whole found out. The mother, after her first fright was over, declared if his father did not horsewhip him, *she* would. *He was not horsewhipped.* His father, without saying a word washed the wound with spirits, wrapped up the finger in paper, put it into his waistcoat pocket, and went to a surgeon's, whom he sent to see the boy, giving him the finger to get anatomically prepared. He afterwards had it mounted in silver, and used it as a tobacco-stopper to the day of his death; and, I dare say, it remains an heir-loom in the family to this hour.—*Page* 139.

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We subjoin three of the author's introductions without copying their corresponding anecdotes, as they do not suit our purpose:

Much has been said, and much alarm occasionally created, on the subject of emigration. I am not disposed to think there is any thing to dread on that head. A few, in the middle ranks of life, with small independencies, may try the experiment; but the lower classes of society, such as mechanics, labourers, soldiers, sailors, &c. &c., will seldom emigrate, while they have a new language to learn, new laws to obey, old inveterate prejudices to overcome, no porter or ale to drink, new cookery to disgust them, and less wages to receive; to say nothing of the expence of travelling, and their children becoming foreigners. Our soldiers have three times as much pay as foreign troops: our sailors nearly the same. Servants' wages may be put on the same footing: mechanics and labourers have different tools to get accustomed to, and, unless they become masters or overseers, (which can only happen to a very few,) not half the emolument;

and, as I before stated, a new language to learn, (which, by the bye, is no joke). Added to all this, our government is free, our press free, our courts of justice open, the administration of it impartial, and our police mild: no secret tribunals, as in other countries; no inquisition; no hereditary soldiership; no wanton caning; no blows; no man privately torn from his friends and family, never more to be heard of. Our condemned convicts even are allowed to be visited by their friends and relations. In short, from what I have seen, the more I contemplate this subject, the less I think it ought to alarm our politicians.—*Page* 14.

In our country, where no sumptuary laws exist, and where every one who can, or supposes he can, may drive with six horses, have laced liveries, and as many servants as he likes, the aristocracy are necessarily put upon their mettle. Merchants, bankers, lawyers, and other successful speculators, are their neighbours to the right and left; and, as the latter are usually spending self-gotten fortunes, they have more at their immediate disposal than hereditary possessors, whose property is entailed upon their eldest son, with perhaps many other children, of both sexes, to provide for. It puts them upon their mettle, as I before observed; and it is only by a superior education, taste, and manners, they can hold the superiority they claim in society. It is not, therefore, to be wondered at if they are more inaccessible, more haughty in their exterior, and more cold and distant in their conversation, than the nobles of other nations, who have not this freedom to contend with. *They* may be familiar: their foibles, their errors, never can sink them to the level of others, because titles, military, and even professional rank, place their possessor above the influence of the riches of the burgeois.—*Page* 82.

Fifty years back it was a swearing, smoking, quidding, punch-drinking, tavern-supping, groggy age; which was followed by a universal love of marechale powder, perfumed pomatum, pinned-up curls, satin breeches, gold knee-bands, touch-the-ground shoe-buckles, and macaroni insipid foppishness, of which the caricatures of that day are no exaggeration; indeed they are only moderate and faithful portraits. Then all was sentiment: sentimental journeys; sentimental novels, plays, and ballads; even sentimental looks and glances. Sentiment was next driven from the field by scepticism, philosophy, and warlike feeling; and the reigning folly was four-in-hand clubs, with their appropriate fopperies of boots, whips, crops, capes, &c. Of late years, there has arisen a dash of military mania, in dress and looks, political animosity, party spirit; turbulent and captious discontent, abuse, and (what is worse than all) blasphemous infidelity.

PLANT THAT DISSOLVES IN WATER.

The plant called *Nostoch communis,* which is found in the south of France, in the form of a green and membranaceous envelope, filled with a species of jelly, containing a number of elongated filaments, has the remarkable property of dissolving in water. It always disappears when the rain has ceased, leaving only a small dry membrane, apparently inorganised, which resumes its original form, by being wetted. A curious paper on this plant, and on the different names it has received, is published by M. Vallot, in the *Journal de Physique,* Mars 1821, tom. 93, p. 216,—227.

EFFECTS OF LIGHTNING ON A PARALYTIC SUBJECT.

Mr. Olmsted, Professor of Chemistry in the College of North Carolina, has published, in the American Journal of Science, vol. iii. No. 1. p. 100, an account of the removal of a paralytic affection by a stroke of lightning. Mr. Samuel Leffers of Carteret County, North Carolina, had been affected with a paralytic affection in his face, which had settled chiefly in the eye. When he was walking in his house during a thunder storm, he was struck down by lightning. After lying senseless fifteen or twenty minutes, he recovered so far as to be sensible of his situation. He recovered the use of his senses and of his limbs by degrees, during the remainder of the day and night; and he felt so well the next day, that he was inclined to give to a distant friend an account of what had happened. He was able to write a long letter, without the use of glasses. Since that time he never felt a symptom of the paralytic disorder; and he concluded, that it had been effectually cured by the shock. He thought, however, that the same cause which restored his sight, impaired his hearing.

THE LEECH OF CEYLON.

This animal is seldom more than half an inch long, and is nearly semitransparent. It is very active, and is said occasionally to spring. Its powers of contraction and extension are very great. It is like a fine cord when fully extended, and its point is so sharp that it easily makes its way through very small openings. It is supposed to have an acute sense of smell, for no sooner does a person stop where leeches abound, than they appear to crowd eagerly to the spot from all quarters. " Those who have had no experience of these animals," says Dr. Davey, " of their immense numbers in their favourite haunts,—of their activity, keen appetite, and love of blood, can have no idea of the kind and extent of annoyance they are to travellers in the interior, of which they may be truly said to be the plague. In rainy weather, it is almost shocking to see the legs of men on a long march, thickly beset with them, gorged with blood, and the blood trickling down in streams. In attempting to keep them off, they crowd to the attack, and fasten on quicker than they can be removed. I do not exaggerate, when I say that I have occasionally seen at least fifty on a person at a time. Their bites are apt to fester, and become sores, and frequently degenerate into extensive ulcers, which, in too many instances, have occasioned the loss of limb, and even of life."—Dr Davy's *Account of the interior of Ceylon.*

IMMENSE QUANTITY OF DRIFT WOOD IN THE RIVER ACHAFALAYA.

The quantity of wood drifted into the River Achafalaya is so enormous, that several hundred miles are converted into solid rafts of wood, which, in the course of every two or three years, disappear under the sand and leaves. By this operation, the bed of the Achafalaya is alternately removed four or five miles to the east, or two or three to the west, but more commonly to the east. On that side, it has already gained more than ten miles since it has become an outlet of that river. When Mr. Bringier landed at the mouth of this river in 1812, when it was at the fullest, he was surprised at the quantity of wood leaping perpetually into the shoot. He then counted the large trees entering the river in a given time, and found that more than 8000 cubic feet passed in a minute; besides leaves, bark, reeds, &c. whose united quantity is probably equal to that of the wood. The rafts on the Red River are equally remarkable This river is about sixty miles in length, and in many places fifteen miles in breadth. In some parts of this river, cedar trees are heaped up by themselves, and in other places pines. At the foot of a hill where nothing else grows, the flood sweeps them into a pile, where they are matted together with their leaves, and with the pods or capsules of their seeds, forming the most compact kind of rafts. Under this raft of the Red River, various small streams disappear, and shew themselves again after having passed several miles under the surface, and under sand-banks, which are probably part of the raft buried under the sand.—The rafts on the Achafalaya have been more recently examined by Mr. Darby, who has given an account of them in his *Emigrant's Guide.* He remarks, that men may pass the river in many plaees upon the wood. The timber, he says, rises and falls with the water,—is continually shifting,—lies in all directions, having large interstices open,—and frequently moves in a body from the weight of the incumbent mass. The raft is described by Mr. Darby as only twenty miles long from its upper to its lower extremity, ten miles of which is completely closed with timber.—*American Journal of Science*, Vol. iii. No. 1. p. 17,—21.

SWORD-FISH FOUND AT KIRKBEAN.

The present summer has been remarkable for the number of large and strange fishes which have been thrown upon our coasts, particularly those washed by the Irish Sea. Perhaps the most remarkable of these is a sword-fish, the *Xiphias gladius* of Linnæus, which was thrown on the coast of Kirkbean, a small maritime tract situated immediately behind that formidable barrier of shallows and sand-banks which protect the western alluvial border of the Solway Frith from the incursions of its ancient possessor, the ocean. This fish measured 10 feet in length, and 4½ feet round the thicker part of the body. The sword, or rostrum, which is the most interesting part of this singular animal, measures three feet three inches in length; and, different from those specimens commonly exhibited or described, resembles in a most remarkable manner the common diamond sword worn by the serjeants of infantry, only its proportions at the root are more uniform, the whole figure being that of a very acute isosceles triangle, whose vertical angle is 4° 42′; —for its greater section is nearly a rhomboid, whose respective sides are 17.5, 33: which last number is its transverse dimension or breadth at the same place in $\frac{1}{10}$ths of an inch. Its thickness there is 3.1 inches: its greatest breadth 3.3 inches; and it weighs 25 ounces, or 1lb. 9 oz. avoirdupois.

The part where the rostrum has been attached to the frontal bone is somewhat softer than the rest, though approaching more nearly to the colour and surface of bone. Internally, however, the appearance is splintery, with parallel fibres, and colour much resembling hiccory. Towards the apex, it becomes more and more solid, and its edges are almost perfectly transparent, and might pass for a deposition of calcareous spar. They are, indeed, easily scratched with a knife, and yield a white streak, but do not effervesce with acids. The point, which does not exceed $\frac{1}{20}$th of an inch in breadth, is likewise, though less perfectly, transparent. It is penetrated for at least 18 inches of its length by four canals. These are half an inch wide at their commencement, and gradually disappear in solid bone. Their use is probably to receive nerves for the purpose of sensation, as the whole mass seems possessed of a strong vibratory power, and, when the nasal end of it is held close to the ear, the slightest touch on the other extremity is instantly perceived. The stethoscope of M. Lænnec rather diminishes than increases this interesting effect. Whoever considers the dimensions, and exquisite mechanical aptitude of this dreadful weapon, more especially when sped with the almost electrical velocity of a fish ten feet long, and nearly (by computation) half a ton in weight, will have little difficulty in conceiving the effect described by Mr. Scoresby in Vol. III. p. 411. of this Journal. The rostrum there described could only have been 28 inches in length, or almost one-half less than that we are now describing; yet the fish had driven it through the bow of a vessel, (the Kitty of Liverpool,) where the thickness in timber and planks was 12 inches of sound oak, besides a sheath of copper. The violence of the shock, however, seems to have broken off the rostrum close to the os frontis. It is very thin there, not $\frac{1}{30}$th of an inch; and though Galileo has shewn that matter disposed as here in a hollow cylindrical form is stronger than when solid, this only obtains in the case of pressure exerted at a distance from the point of resistance; for it must be proportionally weaker, in the event of a shock or oscillation, which, in the instance supposed, would undoubtedy be tremendous. However, the rostrum described by Mr. Scoresby was cylindrical; that above described is flat, but sloping from a regular angle (of 140°) in its middle to a moderately blunt edge on either side. This bevelment is most remarkable on the upper surface, while the lower is marked by *two* corresponding lines, not sharp but rounded. A small suture may be observed on both surfaces, continued from the frontal bone to within six inches of the point, and dividing the rostrum into two equal parts. It seems difficult to conjecture what cause can have seduced this animal so far from the seas which he usually inhabits, and to a coast where few varieties are to be met with, beyond the native tenants of the rivers and banks of Solway. The oldest inhabitants of the adjoining district do not recollect another instance; and if we connect this with the numerous accounts of large fishes lately thrown ashore on the neighbouring coasts, and the almost unprecedented dry season which has just been terminated, it will appear not improbable that these events have a natural dependence on each other. The fishermen of that quarter know how to appreciate the effects of shorter seasons of drought on the fish proper to the coast; and when the term has been prolonged to nearly five times its average duration, it seems rational to infer, that its effects have likewise been carried to a proportionally greater distance among the inhabitants of the deep, and brought the stately stranger we have been considering into shallows, from which all his strength and activity were unable to relieve him.—*Edinburgh Philosophical Journal.*

SINGULAR APPEARANCE OF SNOW AND HAIL.

In January 1809, the Rev. D. A. Clark observed, in Morris County, New Jersey, a regular formation of cylinders of snow. When a deep snow was upon the ground, a shower of rain fell, and, in consequence of a sudden cold, the rain was congealed on the surface of the snow, and formed upon it a cake of ice. Another shower of snow fell to the depth of three-fourths of an inch, and the sky having suddenly cleared, the cold became very intense, and the wind blew a gale. "Nature," says Mr. Clark, "now began her sport. Particles of the snow would move upon the icy crust from 12 to 20 inches, and would then begin to roll, making a track upon the ice shaped like an isosceles triangle. The balls enlarged according to circumstances, and, aided by the declivity of the ground, the rolls were of the size of a barrel, and some even larger. Thus the whole creation, as far as the eye could see, was covered with snow-balls, differing in size from that of a lady's muff to the diameter of 2½ or 3 feet, hollow at each end to almost the very centre, and all as true as so many logs of wood shaped in a lathe."

About two years before, Mr. Clark observed in the heat of summer, hail-stones about one-fourth or three-eighths of an inch thick, and of sufficient size to hide a shilling. Almost every one of them was perforated in the middle, as if they had been held between the fingers, till the fingers by their warmth had melted away the middle, and had met. When the perforation was not complete, there was in every case an inclination to perforation.

Mr. E. Hitchcock observed, at Deerfield, in Massachussets, in 1812 or 1813, cylinders of snow similar to those above described by Mr. Clark, and formed under similar circumstances. None of the cylinders, however, were more than six or eight inches in diameter.—*American Journal of Science*, vol. ii. No. 1. p. 132, and vol. ii. No. 2. p. 375.

METEOR AT AMHERST IN MASSACHUSSETS.

On the 13th of Aug. 1819, between 8 and 9 o'clock in the evening, a fire-ball, of the size of a large blown bladder, and of a brilliant white light, was seen in the atmosphere. It fell near a house, and was examined by Rufus Graves, Esq., formerly Lecturer in Chemistry at Dartmouth College. It was of a circular form, resembling a solid dish, bottom upwards, about eight inches in diameter, and about one in thickness, of a bright buff colour, with a fine nap upon it, similar to that in milled cloth. On removing this nap, a buff-coloured pulpy substance, of the consistence of soft soap, appeared, having an offensive suffocating smell, producing nausea and giddiness. After a few minutes, exposure to the air, the buff colour was changed into a livid colour, resembling venous blood. It attracted moisture readily from the air. A quantity of it in a tumbler soon liquified, and formed a mucilaginous substance, of the consistence, colour, and feeling of starch, when prepared for domestic use. The tumbler was then set in a safe place, where it remained undisturbed for two or three days, and it was found to have all evaporated, except a small dark-coloured residuum adhering to the bottom and sides of the glass, which, when rubbed between the fingers, produced about a thimbleful of a fine ash-coloured powder, without taste or smell. With concentrated and diluted muriatic and nitric acids, no chemical action was observed, and the matter remained unchanged. With the concentrated sulphuric acid, a violent effervescence ensued, a gas was evolved, and the whole substance nearly dissolved.—*American Journal of Science,* Vol. ii. p. 335.

ELECTRICAL PHENOMENA.

On the third of May 1821, and when M. Allamand, *jun.* was walking from Fleurier to Moutiers, in the canton of Neuchatel, he was overtaken by a storm of thunder and lightning. Having closed his umbrella, lest its metallic point should attract the lightning, he perceived a band of light along the rim of his hat. Upon passing his hand over the luminous train, it became still more luminous, and the whole interior of his hand shone like a polished metal when it reflects a bright light. Finding that there was no danger in making this experiment, he repeated it 15 or 20 times. This light was not attended with any crackling noise or electrical smell; it lasted only for a short time, and always resembled a brilliant varnish applied to the surface of his hand.

M. Allamand afterwards perceived another but less lively light upon the polished surface of the cross of his umbrella. Upon moving the slide over the luminous part, it became more brilliant, and in case of any accident he threw it from him. M. Allamand now tried to restore the luminous appearance to the rim of his hat, by rubbing it with the sleeve of his coat, but he could not succeed, which he attributed to the tall poplars which grew on the side of the road having attracted the electricity from the atmosphere. When he recovered his umbrella, he saw luminous points at the extremities of the whalebone radii, which are terminated with a piece of metal. See the *Bibliotheque Universelle,* Juin 1821, Vol. xvii. p. 154.

PHOSPHORESCENCE OF MARINE ANIMALS.

During a voyage to the Shetland and Orkney Islands, Dr. Mac Culloch had various opportunities of investigating the phenomena of marine luminous animals. In proceeding from the Mull of Cantyre to Shetland, and in almost all the harbours of Shetland and Orkney, Dr. Mac Culloch found the water filled with a species of animal which he considers to have been undescribed. A cubic inch of water did not contain less than 100 of these animals. In the same view, and nearly at all times, the water was found filled with several different species, resembling in size some of the infusoria. Other animals of larger dimensions, and of many species, were equally constant, and, if less numerous, yet ten or twenty were always to be found within the space of a common tumbler glass. In all these cases the water was luminous. The light of the whole of these species disappeared, when they died, either from keeping the water too long, from warming it, or from the addition of spirits. Dr. Mac Culloch has added upwards of 190 species to the list of luminous marine animals. The most conspicuous among these are about twenty small species of Medusa, in addition to those already known to be luminous. In the ancient genus Cancer, a considerable number of Squillæ were also found possessed of phosphorescence. In the genera Scolopendra and Nereis, five or six were luminous, which were all the species observed by Dr. MacCulloch. The other known genera in which luminous species were observed, were Phalangium, Monoculus, Oniscus, Iulus, Vorticella, Cercaria, Vibrio, Volvox; to these Dr. Mac Culloch adds, among the fishes, a new species of Leptocephalus. The remaining luminous animals consisted of new genera, or at least of animals which could not be referred to any as yet to be found in authors. Dr.

Mac Culloch seems to think, that the ling and other fish which inhabit the submarine valleys, at depths to which the light of day cannot penetrate, must perceive their food, and pursue their avocations, by the phosphorescence of their prey, or of the animals which abound in the sea, or by phosphoresencc elicited from their own bodies. Dr. Mac Culloch's observations were generally made in harbours, but never at a distance exceeding eight or ten miles from land. See the *Journal of Science, Literature,* &c. Vol. xi. p. 248.

The following statement on the same subject is given in the *Edinburgh Philosophical Journal,* by FRANCIS BUCHANAN, M. D.

About a quarter past seven P. M. the sea was observed to be remarkably white. The sky was every where clear, except around the horizon, where, for about 15°, it was covered with a dark haze, as is usual in such latitudes. The whiteness gradually increased till past eight. The sea then was as high coloured as milk, very much resembling the milky-way in the heavens; the luminous appearance of the sea resembling the brighter stars in that constellation. It continued in this situation till past midnight, and only disappeared as day-light advanced. The whiteness prevented us from being able to see either the break or the swell of the sea, although both were considerable, as we knew from the motion of the ship, and the noise. There was much light upon deck, as we could discern all the ropes much more distinctly than usual. We drew several buckets of water, in which, even when at rest, there appeared a great number of luminous bodies. The bulk of them did not appear to be more than ¼th of an inch in length, and nearly as much in breadth. Some, however, were 1½ inch long, and of the same breadth as the others. These were seen to move in the same manner as a worm does in water. When taken up on the finger, they retained their shining faculty even when dry. When brought near to a candle, their light disappeared; but, by minute attention, an extremely fine white filament could be observed, and lifted upon the point of a pin. It was of an uniform shining colour and form, and about the thickness of a spider's thread. In a gallon of the water, there might be about 400 of these animals emitting light. The water itself, when in the bucket, had a natural appearance. The atmosphere was seemingly free from fog. The stars were bright, and there was no moon-light.

The night before, the same appearance was observed at ten P. M. It lasted only twenty minutes; but, as I was below, I did not hear of it till it was over. The chief mate and other officers had observed the same appearance formerly in the same sea. They had several times, however, passed it, without observing any thing similar. No one on board had seen any thing of the kind in any other sea, except the gunner, who, in a voyage to China, had seen it off Java Head. The captain of the vessel in which he was, being alarmed, hove too immediately, sounded with 50 fathoms, but meeting with no ground, he proceeded on his voyage.

THE CLIMATE OF SOUTHERN AFRICA.

Dr. Knox has lately published, in *the Edinburgh Philosophical Journal,* several useful Meteorological tables, as extracts from a Register of the weather, which he kept during his residenee at GRAAF REYNET, a well known flourishing Missionary settlement in South Africa. At the close of them he makes the following statement:

Hitherto all Meteorological observations have been limited to Cape Town, or at least to the *Cape peninsula,* which, from its almost insular situation, its lofty mountains, deep bays, and proximity to the ocean, possesses a climate having little in common with the more inland tracts of Southern Africa.† Calamitous droughts, it must be allowed, not unfrequently extend over the whole colony, and affect even the Cape peninsula; but rains are very partial, deluging particular districts, whilst others are totally deprived of them. The boisterous south-east winds, which blow with such tempestuous violence at the Cape, are scarcely ever felt in the interior; a fact which, combined with many others, demonstrates the inaccuracy of those who would deduce from observations made in the Cape Town, any inferences or conclusions relative to the mean annual temperature, or the general meteorological state of Southern Africa. One of the advantages arising to mankind from the acquisition of meteorological knowledge, and that not the least, is the detection of the salubrity or unwholesomeness of the various climates which the surface of the globe presents.

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† The thermometrical observations of a traveller, who is hourly altering his elevation above the sea, and degree of latitude, are of course unworthy the smallest attention.

Whatever conclusions may be drawn as to the nature of the climate of Southern Africa, (as far as is known to Europeans,) from the preceding or other meteorological tables, *experience* shews, that it is one of the *healthiest* in the world.

Epidemics, those terrific scourges of mankind, are unknown; the dreadful fevers arising in marshy countries, from the combined effects of moisture, and a greatly increased or diminished temperature of the air, are never found in the colony of the Cape. During summer, the excessive heats occasionally excite bilious fevers in the young, chiefly of the male sex, and the hot N. and NW. winds give rise, in some cases, to nervousness and oppressed breathing. The same N. and NW. winds become in winter piercing cold, and occasion a considerable mortality amongst infants, by exciting inflammatory complaints of the chest; these winds are moreover extremely parching, and dry up the moisture of the face, lips, and inner membrane of the nostrils; their effects on the vegetable kingdom are similar. The medical man, and even the general reader, will readily imagine, from a perusal of the thermometrical tables, that the colony of the Cape must be ill adapted for the abode of the consumptive. Experience, to which we can never too often recur, demonstrates the accuracy of this deduction. Pulmonary consumption is not an unfrequent disease with the colonists, and annually cuts off great numbers of the class of natives called *Hottentots.*

MEDICAL REMARKS ON THE TEMPERATURE OF THE NORTH ATLANTIC OCEAN.

The same gentleman has also published a Table which exhibits *the general temperature of the North Atlantic Ocean, and of the superincumbent atmosphere,* on which he makes the following observations:

From the above table, and a few others which exist, may be seen the remarkable equability of temperature enjoyed, as well by the great ocean, as by the superincumbent atmosphere. This, which is neither disturbed by storms, nor changes of seasons, nor by the vicissitudes of day and night, has not been sufficiently insisted on by meteorological, and but ill understood by medical writers. Hence we find them attributing to various occult qualities the healing powers of marine air in several diseases, and more particularly in pulmonary consumption. Either not understanding, or not believing in the extraordinary equability of temperature which prevails in the air over extensive oceans, they have ridiculously ascribed the effects arising from this alone to the "saline humidity of marine air; to its greater density and elasticity; and to its being more agitated by winds." Nearly all the facts which the Annals of Medicine contain, tend to prove, that, to the mildness and equability of marine air, is to be ascribed its extreme salubrity in consumptive diseases; and by reflecting on this fact, we may see the absurdity of directing consumptive patients to sail along a coast, or in an inland-sea, where the temperature of the marine air differs but little from that of the neighbouring continent or island, It is, for example, well known to Greenland whalers, and seafaring men trading to the North Seas, that the Baltic is often frozen, when the great ocean, ten degrees farther north, is open, and the weather mild. Seamen are made aware of the vicinity of land, by the sudden cooling of the air and of the sea; and this, indeed, is reckoned an almost infallible test of their approaching the coast.

The effects of the sun's declination on the temperature of the great ocean situated within the Tropics, or of its atmosphere, are inconsiderable. This is sufficiently proved by tables of the temperature, which have been kept by some individuals, and by the uniform weather experienced whilst crossing these fatal climates. Yet there would seem to exist a certain difference between the climate of the northern and southern hemispheres, even within the tropics. The very peculiar climate called by sailors the *Rains*, is found to exist only to the north of the Line, between the Equator and the 13th degree of north latitude. These *Rains* extend nearly across the ocean, in a belt, varying in breadth, but having generally about ten degrees of latitude. They are felt in every degree of longitude between 5° and 30° W., nor are they experienced more severely at any one point than another. Formerly, when the art of navigation had not reached that perfection which it has now attained, vessels bound to the southern hemisphere were wont to make disastrous voyages, attributable often to delays of many weeks whilst crossing this belt or zone. The calms which constantly prevail, are attended with alarming squalls, heavy gales, and almost continual rains. A sultry and intolerable suffocating heat, which at no season of the year is absent, occasions fevers among the crew, and gives a temporary shock to the strongest nerves. This is not to be ascribed altogether to the actual temperature of the air in this climate, but to its being combined with *moisture*, to which union may fairly be attributed the origin of most epidemic fevers. The meteorologist will readily imagine the direful effects likely to arise to the human frame, when the temperature of the air, and its humidity, are much increased beyond what happens at sea, between the latitudes of 15° N. and 15° S. But innumerable meteorological observations shew, that large continents, or extensive islands, possess a climate totally different from that of the great ocean, the temperature of the air being much increased during summer, and diminished in winter; and moreover, being liable to sudden alternations from hot to cold, and *vice versâ;* changes which never happen at sea. The atmosphere also over land, is apt in various situations to become surcharged with moisture, which, combined with great heat, is the undoubted cause of those fatal fevers known in various parts of the world, under a variety of names, by some supposed to originate in contagion, and by others in *marsh miasmata.* In temperate and cold climates, a humid atmosphere gives rise to intermittents or agues.†

When we examine the great zone comprised between 20° N. and 15° S. latitude, we find that nearly all those places which have been rendered famous by the destruction of European adventurers, are included in it. On the American continent, may, as a specimen, be mentioned the ports of Vera Cruz, the Bay of Honduras, Darien, St. Juan, St. Lucie, Trinidad, the mouths of the Orinooco, Surinam, and Demarara. In Africa, Senegal, Goree, Sierra Leone, and Benin. In the east are Ceylon, Sumatra, Borneo, and Batavia.

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† It cannot surely be necessary to point out to those accustomed to meteorological enquiries, that the atmosphere resting on the great ocean, by the equability of its temperature, and the uniformity of its qualities as to moisture, will, under very few circumstances, be found capable of exercising over the human frame the same dreadful powers as the inconstant air of a continent or large island, subject to endless variations, from the change of seasons, and even by the alternation of day and night. The doctrine of *marsh miasmata* may fairly be ascribed to an unwillingness in the human mind to admit as the sole cause of destructive epidemic fevers a phenomenon so simple as a change in the constitution of the atmosphere, regarding its temperature or moisture; and one, too, apparently so inadequate to the production of such dire effects. Those who cannot explain the origin of remittent and intermittent fevers, without having recourse to *marsh miasmata,* will find it difficult to account for the absence of agues in the district of *Lammer Muir,* (about twenty miles south of Edinburgh,) since the cutting down and destruction of the forests with which that country once abounded.

MEMOIR OF THE LATE JOHN RENNIE, ESQ., F. R. S.

Mr. John Rennie was born near Linton, in the county of East Lothian, Scotland, in the year 1760. His father, George Rennie, who was a respectable farmer in that neighbourhood, and whose family consisted of three sons, of whom John was the youngest, died when he was about seven years old, in consequence of which his early education devolved on his mother and his elder brother George. After some time, he was sent to a neighbouring village school, where he merely learned the rudiments of arithmetic, in connection with reading and writing, nothing higher being professed by the master.

Contiguous to Mr. Rennie's farm, was a house, which for many years had been occupied by Mr. Andrew Meicle, an ingenious millwright, to whom that branch of machinery is indebted for many important improvements. Mr. Meicle, who had long been intimate with the family of Rennie, on finding the children deprived of their father, to evince his attachment, undertook to instruct the younger son in a knowledge of his profession. Whether the lad at this time manifested any dawnings of superior genius, which attracted the attention of Mr. Meicle, we have not been informed. Be this, however, as it may, the offer was deemed advantageous, as Mr. Meicle was at this time in the zenith of his popularity, and was considered as one of the first practical millwrights that either England or Scotland could produce. A bargain being made, young Rennie entered on his employment, and continued with his master about six years, during which time he applied himself with so much assiduity, that on the expiration of the term, he was completely master of his trade. In addition to this, as modelling was taught by Mr. Meicle, young Rennie had also made a considerable proficiency in this branch; and so ardent was his desire to obtain a complete knowledge of its scientific principles, that he was rarely to be found without a wheel, or some section of one, in his pocket.

On quitting his master, he commenced business on his own account; but finding that Scotland afforded no inviting prospect to a mere practical millwright, his eyes were turned in various directions to watch the movements of science; and his ambition prompted him to seize the first favourable opportunity that should present itself, in which he might display his talents, and procure a more ample reward for his labours, than Scotland at that time could promise.

Prior to this period his countryman Mr. Watt had formed a connection with Mr. Bolton, and fame and fortune were beginning to reward his ingenuity with honours and with wealth. In 1783, Mr. Rennie having attained his 22d year, on learning that Bolton and Watt were applying their steam-engines to millwork, and that the Albion mill, at Blackfriars' Bridge, had been projected, applied to them for employment; and on being accepted at the fixed salary of one guinea per week, he relinquished his trade, and immediately repaired to London, to try his fortune under the auspices of Bolton and Watt. Shortly after his arrival, the Albion mill was undertaken; and as his employers were unacquainted with its management, and particularly so with the grinding department, which Mr. Rennie perfectly understood, the superintendence of the whole devolved on his integrity, attention, and abilities; and it was finally completed by him to the satisfaction of his employers.

Shortly after the Albion mills were finished, the machinery of Whitbread's brewery was undertaken, and finished also under Mr. Rennie's direction. These works gained him a considerable degree of fame; and as his reputation was now becoming somewhat established, he thought this a favourable moment to commence business for himself in the metropolis of the British empire.

To render this crisis the more inviting, several circumstances at that time concurred; among which, the recent death of Mr. Smeaton, the celebrated engineer, was one of much importance, his death having left a vacancy in this department of science. A new power had also been just discovered, and applied to machinery; but being in its infancy, the extent of its influence was at that time unknown. Mr. Rennie was connected with the patentee, and under his immediate protection; he was therefore surrounded with the prospect of advantages which might never again occur, and under their combined auspices he announced his intention to the public. It was also much about this time that he formed an acquaintance with Mr. Robert Grazier, by whom he was instructed in the canal business, and taught the method of introducing and carrying through Parliament, bills for the cutting of canals, and the construction of bridges.

At the age of twenty-five, Mr. Rennie married a Miss Mackintosh, by whom, in process of time, he had nine children, six of whom have survived their parents, Mrs. Rennie dying a few years since; and it is probable that two of them will succeed their father in his business, and fill that station in the ranks of public utility, in which he acquired such distinguished honours.

In the year 1794, Mr. Rennie took his stand at the head of the civil engineers of this country, which station he continued to occupy until the day of his death. During this interval, scarcely any work of magnitude and importance was undertaken, in which he was not engaged; and it is to his genius and persevering application that England is indebted for those scientific labours, in which it claims a decided superiority over those of other countries. Canals, bridges, harbours, wet docks, and machines of almost every description, came within the range of his powers, which at the same time gave directions to several workmen who were constantly employed in the more immediate line of his profession, as a mill-wright.

Among his public works, Ramsgate harbour, the London docks, Waterloo and Southwark bridges, and the Break-water at Plymouth, will hand his name to posterity. But the Bell Rock light-house, constructed on the same principle as the Eddystone Light-house, by Mr. Smeaton, will, perhaps, be considered as the greatest effort of his masterly genius. Although these works form only a small part of his labours, they are sufficient monuments of his glory, to crown him with immortality among his fellow men. Various parts of the kingdom bear testimony to the greatness of his mind, and to the success of his perseverance, in each of which he may be said to have stood without a rival.

If we compare the works of Mr. Rennie with the greatest exploits of the best French engineers, his fame will acquire new lustre from the comparison. What are the Cassoons of Cherburg, when placed in competition with the Break-water at Plymouth? What is the canal of the Ourke, when measured with any one cut under his direction? And what is the bridge of Neuilly, when compared with that of Waterloo? The decided superiority of Mr. Rennie's works is acknowledged by every liberal Frenchman.

It was reserved for the genius of Mr. Rennie to contend with, and to bind in chains, the elements of nature. The violence of rapid torrents he confined within specific boundaries; the violence of the most boisterous seas he has subdued; and on the frontiers of harbours, which were previously dangerous, he has planted safety. Districts of fruitful land he has rescued from the incursions of the ocean; and by draining bogs, he has driven pestilence from the once stagnant marsh. He has levelled hills in some places, and in others tied them together by aqueducts and arches, and thus rendered the wild elements of nature subservient to the conveniencies of man.

To the various works in which he was engaged, he applied all his talents; and as his labours were for posterity, he disdained to avail himself of those mean artifices by which too many make dishonourable fortunes, by giving an imposing exterior to his labours which the most rigorous scrutiny of the concealed parts would not most amply justify. This was the line of conduct which he pursued in all his private concerns, and on public works which were placed under his direction, he compelled those whom he employed to adhere to the same principle. An enforcement of this, in connection with his favourite avocations, so fully occupied his time, that on his visiting France for a short period in the year 1816, he declared it to be the first relaxation from unremitting labour he had taken for nearly thirty years.

Accustomed to rise early, he frequently made appointments at five in the morning, and it was very rarely that he became disengaged from business until nine at night. In all his undertakings, punctuality, order, and regularity, were his invariable maxims, which were not merely adopted in theory, but exemplified in his practice.—As a master, he was obeyed by all in his employment, from an acknowledgment of his superior talents, and this was accompanied with a respect that always enforced submission.

It has sometimes been said, that in his estimates he was generally too low for the gigantic works which he undertook and accomplished, especially, as in the execution of his designs, he spared no labour or expense. Some who have thus blamed hlm, would no doubt have pursued a different mode of conduct, but Mr. Rennie found no occasion to resort to such expedients to amass wealth, for by his own prudential maxims, and practical economy, he contrived to realize a considerable fortune, which he has left to an accomplished family to enjoy.

Engaged in business which allowed no intermission, Mr. Rennie had no time to devote to literature. He has therefore left no memoirs behind him, nor any documents by which his talents in the departments of letters may be estimated. He was, however, elected a Fellow of the Royal Society, and no doubt, had he been ambitious of farther honours, he might easily have obtained them, from his talents, and commanding connections.

Raised from a comparatively humble situation, by his own intrinsic merit and persevering industry, to the highest eminence in the scientific profession which he pursued, he was always ready to assist by his superior talents every effort of genius struggling with adversity in humble life, without betraying those jealousies and suspicions which characterize ignoble minds.

Mr. Rennie, after a long illness, from which he had partially recovered, suffered an unexpected relapse, and paid the debt of nature at his house in Stamford-street, Blackfriars, on the 4th of October, 1821, in his 61st year.

His funeral was attended with considerable pomp. A hearse drawn by six horses, sixteen mourning coaches, and nineteen private carriages, several of which were drawn by four horses, graced the procession. Among those who honoured the funeral with their presence, in addition to his own immediate friends and family connections, between twenty and thirty individuals, distinguished in the various walks of science for their illustrious acquirements and scientific abilities, attended on the solemn occasion.

Proceeding to St. Paul's cathedral, where the interment took place, the corpse was taken from the hearse at the bottom of the steps, and, followed by sixty mourners, was carried into the little chapel on the north side of the church, and finally interred in a vault at the east end, and on the south side of the building, near the tomb of the late Lord Collingwood.

Mr. Rennie, in his person, was tall and well made, possessing an agreeable countenance and an affable address. Advancing in years, this affability settled into a serious habit, but his native cheerfulness never degenerated into a gloomy reserve. In all his dealings, uprightness and integrity marked his conduct; nor was he ever known to resort to dishonourable expedients, to induce his employers to undertake works of importance. On such occasions he always set before them a full view of the various obstacles they would have to surmount, and the difficulties they must encounter.

Mr. Rennie cultivated his art with the most enthusiastic ardour, but instead of being a mere theorist, he prepared himself for practical efficiency by visiting, and minutely inspecting in every country all works of magnitude that bore any similitude to those in which he was engaged, or might probably be called on to construct. Hence his library abounds in a richer collection of scientific writings, than that of any other individual.

As a millwright, society is indebted to him for showing how the power of water may be most advantageously applied. He has given an increase of energy to the natural fall of streams by their specific gravity, and made his mills equal to four-fold the produce of those, which before his time depended solely on the impetuosity of the current. His mills of the greatest magnitude work as smoothly as clock-work, and by the alternate contact of wood and iron, the machinery is less liable to take fire from friction.

THE FRENCH CHEMIST, B. G. SAGE.

This celebrated man, whose attainments and discoveries in the Arts are known to all Europe, has lately published a pamphlet in which he details some of the losses that he had sustained during the French Revolution, and the various changes which succeeded. His statements are confirmed by some Memoirs of him, which appeared in the *Biographe des Hommes Vivants*.

He was born at Paris, in 1739, and attached himself in early life to the study of Chemistry, in which he became a great proficient.

In 1790 (says M. Sage), Le Brun, since called Duc de Plaisance, who was then President of the Committee of Finance in the Constituent Assembly, caused that body to pass a decree, by which I was ordered to send my collection of Mineralogy to the garden of plants, and to transfer thither the "Royal School of Mines," which, at my earnest solicitation, Louis XVI. had created in 1783, and to which twelve pupils with salaries were attached. By the same decree also, I was deprived of my salary as professor of assaying (*Docimacie,*) which chair had been procured for me in 1778 with a salary of 2000 francs, about £80.

In 1793, three of my pupils, who were zealous patriots, were appointed agents of Mines by the Committee of Public Safety. In the mean time I was thrown into prison, and confined in an infectious dungeon, where I first began to lose my sight. I was then deprived of my salary of 6000 francs as Commissioner of the Assaying of Minerals. They then appointed Hauy and Vouquelin to supply my place of Professor of Assay and Mineralogy, and decreed that my collection should be transferred from the Jardin des Plants to the Hotel des Mines. In 1797, the Executive Directory, in order to recompense me in some degree for the wrongs I had suffered, ordered me a pension from the funds of the *Ponts et Chausseés*, the pupils from which establishment had attended my lectures for twenty years. This pension was suppressed by M. Chaptal, when Minister. Before the revolution, all my works had been printed at the Louvre; but in 1810, not hoping to be allowed the same favour, I requested M. Montalivet, Minister of the Interior, to assist me with 10,000 francs from the funds set apart for the encouragement of science, for the purpose of printing an edition of my "Institutes of Natural Philosophy and Mineralogy." It was agreed to allow me 6000 francs; but I never received a sous, and could get no answer to my application.

Having in 1782 given up to the use of the government a part of my collection of minerals, &c. for an annuity of 5000 francs, this was in 1796 reduced to one third. The Ministry having also assigned me a salary of 3000 francs, to assist me in fulfilling the engagements I had entered into for the embellishment of the Museum of Minerals, M. Vaublanc informed me I could not receive it.

Thus it appears that I have been deprived of near 24,000 francs a year, and it has been in vain that I have from every minister since attempted to obtain any recompence. I have been a Professor more than sixty years, I created an establishment of the highest utility to France, I formed the first collection of minerals for public use at my own expense,—and what has been my recompense? When I was suffered to leave the dungeon in which I had been confined, my sight was almost gone, I could no longer distinguish the difference of colours or form. I was then placed in a *Maison de Sainté*, under the inspection of Fouquier-Tainville, who informed me that I was denounced because I had received the Queen and Royal Family at my country-house. This was true: but was then regarded as a crime; and I obtained my liberty and life only at the expense of my fortune; but adversity has not destroyed my courage. I reflect, that I have been useful, and I have found real happiness in continual enjoyment.

Eighty-two years old, and deprived of sight and fortune I hope that those who are invested with power, will consider the position to which I have been cruelly and unjustly reduced: but at all events—

Non omnis moriar: exegi monumentum &c.

THE FASCINATION AND PERFUMES OF SNAKES.

Mr. Howison, in his *Sketches of Upper Canada*, gives some curious information of the perfume and fascination of these reptiles; the former property is novel; the latter has been a question of dispute among naturalists. In reference to these facts, Mr. Howison says:—

In Upper Canada it is almost universally believed, that snakes possess that power of fascination which has often been denied them by naturalists. Many people have had the fact demonstrated to them by being witnesses of it, and this was the case with me. One summer day, when strolling through the woods, I came to the edge of a small pond of water, on the surface of which floated a frog in a state of motionless repose, as if basking in the sun. I carelessly touched his back with a stick, but, contrary to my expectation, he did not move; and, on viewing him more closely, I perceived that he gasped in a convulsive manner, and was affected with a tremor in his hind legs. I soon discovered a black snake coiled up, lying near the edge of the pond, and holding the frog in thraldom by the magic of his eyes. Whenever he moved his head to one side or the other, his destined victim followed it, as if under the influence of magnetic attraction; sometimes, however, recoiling feebly, but soon springing forward again, as if it felt 'a strong desire with loathing mixed.' The snake lay with his mouth half open, and never for a moment allowed his eyes to wander from his prey, otherwise the charm would have been instantaneously dissolved. But I determined to effect this, and accordingly threw a large chip of wood into the pond. It fell between the two animals—the snake started back, while the frog darted under water, and concealed itself among the mud.—It is asserted by some that snakes occasionally exert their powers of *fascination* upon human beings, and I see no reason to doubt the truth of this. An old Dutchwoman, who lives at the Twelve Mile Creek in the Niagara district, sometimes gives a minute account of the manner in which she was *charmed* by a serpent; and a farmer told me that a similar circumstance once occurred to his daughter. It was on a warm summer day, that she was sent to spread wet clothes upon some shrubbery near the house. Her mother conceived that she remained longer than was necessary, and seeing her standing unoccupied at some distance, she called to her several times, but no answer was returned. On approaching, she found her daughter pale, motionless, and fixed in an erect posture. The sweat rolled down her brow, and her hands were clenched convulsively. A large rattle-snake lay on a log opposite the girl, waving his head from side to side, and kept his eyes steadfastly fastened upon her. The mother instantly struck him with a stick, and the moment he made off the girl recovered herself and burst into tears, but was for some time so weak and agitated that she could not walk home.

Being fatigued with riding, I dismounted, and seated myself at the foot of a large tree that overhung a small stream, in which little trout sported incessantly. Every breeze was loaded with vegetable fragrance; but at intervals I felt a most intoxicating perfume, the source of which I was for some time unable to discover. At last I saw *two small snakes* creep from under a decayed tree that lay near me, and found from the momentary increase of the odour, and its diminution as they retired, that it proceeded from them. These animals (as I was afterwards informed), while basking in the sun, emit a delightful fragrance; but they are destitute of this peculiarity when dead.

The mode of shooting partridges practised in America, is founded upon the principle of fascination. The partridges there, when raised in a covey, generally settle upon the lower branches of a tree, and the sportsman can kill the whole flock, if his dog sits under the roosting place and barks at the birds. They are so completely entranced by the voice and gaze of the animal, that they neither hear the sound of the fowling piece nor see the smoke, and suffer themselves to be deliberately shot at, without making any attempt to escape; but if the dog leaves his station for a moment, they will all take flight.

QUADRATURE OF THE CIRCLE.

M. Scamarella, a Venetian Geometrician, announces in the Gazette of Venice of 23d November, that he has solved the Problem of the Quadrature of the Circle, and that he is ready to demonstrate it incontrovertibly to all the Mathematicians in the world. According to M. Scamarella, the Superficies of a Circle is equal to the square of the proportional between the diameter of the circle and a line equal to three fourths of the same diameter. It is also equal to the square of the circumference multiplied by half the radius, estimating their ratio as 7 to 21, and not as 7 to 22, as Archimedes taught. M. Scamarella farther engages to solve all the most difficult problems of this nature, *in faccia a qualcunque Matematico.*

FEMALE HEROISM.

A very extraordinary circumstance lately occurred at Munich:—A servant-maid being in a garden with a child nine months old, set it down on the ground, when suddenly an eagle darted from the air to seize upon it as a prey. The servant, who was fortunately close by, with the greatest courage and presence of mind threw a shawl at the bird, which, covering his eyes, not only prevented him from seizing the infant, but even from escaping. She then boldly caught hold of the robber, and in spite of his struggles held him fast till some persons came to her assistance. His Majesty amply rewarded the heroine, who received some wounds in the contest; and sent the prisoner to the menagerie at Nymphenburg.

THE RAMBLER.

THERE are a set of papers that have come out twice a week, ever since the latter end of March, entitled the *Rambler*, that are all distinct essays on various subjects, and which I think extremely well written. The subjects, the manner of treating them, and the language, I think very much in the style of Mr. Melmoth, the author of Sir Thomas Fitzosborne's Letters, and the translator of Pliny's; but I have not heard that he is the writer of these papers, nor a guess from any body I meet, who is.—*LADY HERVEY'S Letters.*

ANSWERS
TO THE
QUESTIONS FOR YOUTH,
Proposed in the Fourth Number of the Third Volume.

(1) *By* Master WILLIAM PICKUP.

The temple of the three graces at Athens stood upon a rectangular area, the length of which exceeded its breadth by three paces; and the distance from one angle to that which was diametrically opposite to it, exceeded the length also by so many paces. How much were its length, breadth, and diametrical distance?

By Master C. BARTHOLOMEW.

Suppose the breadth $= x$; then the length will be $= x + 3$, and the diameter $x + 6$. By 47.1, $x^2 + 12x + 36 = 2x^2 + 6x + 9$. By transposition, $x^2 - 6x = 27$. Complete the square, $x^2 - 6x + 9 = 36$. Extract the root $x - 3 = 6$, or $x = 9$. Therefore the breadth $= 9$, the length $= 12$, and the diameter $= 15$.

By Master WILLIAM CADMAN.

When the length, breadth, and diagonal of a rectangle are in arithmetical progression, the breadth is equal to three times the common difference; hence

$3 \times 3 = 9$ the breadth, and $9 + 3 = 12$ the length, also $\sqrt{(9^2 + 12^2)} = \sqrt{225} = 15$ the diagonal required.

(2) *By* Master CHARLES MACAULEY.

Given $3x^n\sqrt[3]{x^n} + \frac{4x^n}{\sqrt[3]{x^n}} = 4$, to find x.

By the Proposer and Master R. ANDERSON.

This, by ordering, becomes $3x^{\frac{4n}{3}} + 4x^{\frac{2n}{3}} = 4$, or $x^{\frac{4n}{3}} + \frac{4x^{\frac{2n}{3}}}{3} = \frac{4}{3}$. Complete the square, and $x^{\frac{4n}{3}} + \frac{4}{3}x^{\frac{2n}{3}} + \frac{4}{9} = \frac{4}{9} + \frac{4}{3} = \frac{16}{9}$. Extract the root, and $x^{\frac{2n}{3}} + \frac{2}{3} = \frac{4}{3}$, or $x^{\frac{2n}{3}} = \frac{2}{3}$ and $x = \left(\frac{2}{3}\right)^{\frac{3}{2n}}$.

(3) *By* Master WILLIAM ARMITAGE.

At a certain place in the Northern hemisphere on the 21st of June the sun's true altitude at ten o'clock A. M. was 53°, and 3 hours afterwards it was 58° 20′. Required the latitude of the place.

By Master WILLIAM CADMAN.

By the globe. With a pair of compasses take 37° (the complement of the first altitude,) from the equator, and with one foot on the Tropic of Cancer at the point where the meridian of 30° East crosses it, describe a circle; and with 31° 40′ (the complement of the second altitude,) taken also from the equator, and one foot on the said Tropic where the meridian of 15° West crosses it, describe another circle, cutting the former in two points. These points being brought to the meridian, will be found in the latitudes of 53° North, or 3° South, and either of them will answer the conditions of the question.

The Proposer and Master C. Bartholomew, by computation, both find the latitude 52° 53′ 38″ North.

(4) *By* Master James Bramwell.

Two persons A and B begin from the same place and at the same instant of time, to walk both one way round a circular garden whose circumference is 480 yards. Now B is observed to take 6 paces to A's 5; but 4 of A's paces are equal to 5 of B's; how many miles will A go before they are next together, allowing no intermission?

By Master W. Cadman.

The velocity of A is to the velocity of B as 5 × 5 : 6 × 4, or as 25 : 24. Therefore A gains one yard on B in going 25; hence 1 yd. : 25 yds. :: 480 yds. : 12000 yds. $= 6\frac{9}{11}$ Miles, the answer.

(5) *By* Master Hugh Huntington.

There is a circular grass plot, which is to be converted into a flower garden, and raised 6 inches higher by means of a surrounding ditch, whose breadth and depth are equal. It is required to determine the area of the garden and the capacity of the ditch, the diameter of the garden and the ditch being 26 yards.

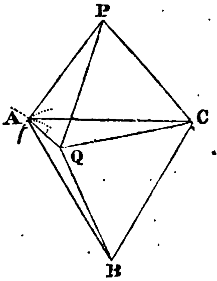
By Master W. Pickup.

Put $4n = 3.1416$, $d = 26$ the diameter of the garden and ditch together, and $\frac{1}{2}x =$ the breadth and depth of the ditch; then $d - x =$ the diameter of the garden, and $d - \frac{1}{2}x =$ the diameter to the middle of the ditch. As $1 : 4n :: d - \frac{1}{2}x : 4nd - 2nx$, the circumference at the middle of the ditch. Hence, by the question, $n \times (d - x)^2 \times \frac{1}{6} = \frac{1}{4}x^2 \times (4nd - 2nx)$, or $(d - x)^2 \div 6 = \frac{1}{4}x^2 \times (4d - 2x)$; that is, $d^2 - 2dx + x^2 = 6dx^2 - 3x^3$, or $3x^3 + 1 - 6d \,.\, x^2 - 2dx = -d^2$, or, in numbers, $3x^3 - 155x^2 - 52x = -676$, from which equation x is found $= 1.98$ yards. Therefore the breadth of the ditch is $1.98 \div 2 = .99$yds. and the diameter of the garden equal 24.02 yards. Consequently the area of the garden is 453.244 square yards, and the content of the ditch 75.54 yards.

(6) *By* Master Henry Ward.

Given the three distances from the three angles of an equilateral triangle to a point within it, to construct it geometrically.

By Master C. Bartholomew.



Make CQ = the greatest distance, and upon it describe the equilateral triangle QPC; from the points Q, P describe (with the two other distances,) arcs cutting each other in A; join AC, and upon it describe the equilateral triangle ABC: it shall be the required one. Join AP, AQ, QB.

Since the ∠ PCQ = ∠ ACB, by taking away the common ∠ ACQ the ∠ PCA will be = ∠ QCB, and the two sides PC, AC are = to the two sides QC, CB. Therefore the triangle PCA = the triangle QCB, and the sides PA, QB are equal. ABC is therefore the required triangle.

(7) *By* Master Michael Scholefield.

There are two geometrical progressions, each consisting of three terms, the sum of the two extremes of the first added to the greatest extreme of the second makes 589: the mean of the first multiplied by the last extreme of the second makes 21294: the mean of the second multiplied by the greatest term of the first produces 39312. Required the progressions, the sums of the two first terms of each being equal,

By Master W. Cadman.

Let w, wx, wx^2, and y, yz, yz^2 be the progressions; the two second conditions of the question give $w \times yz^2 = 21294$, and $wx^2 \times yz = 39312$; hence, dividing the former by the latter, we get $z \div x = 13 \div 24$, or $z = 13x \div 24$. This value of z being substituted in the second progression, gives y, $13xy \div 24$, and $169x^2y \div 576$, and we have the three following equations: viz. $w + wx^2 + (169x^2y \div 576) = 589$, $(169wx^3y \div 576) = 21294$, and $w + wx = y + (13xy \div 24)$. From these quations we find $w = \dfrac{576 \times 589 - 169x^2y}{576(1 + x^2)}$, $w = \dfrac{576 \times 126}{x^3y}$, and $w = \dfrac{y(24 + 13x)}{24(1 + x)}$. Hence $\dfrac{576 \times 589 - 169x^2y}{576(1 + x^2)} = \dfrac{576 \times 126}{x^3y}$, and $\dfrac{576 \times 126}{x^3y} = \dfrac{y(24 + 13x)}{24(1 + x)}$, and exterminating y, $1178x^2 \times \sqrt{\left\{\dfrac{21(1 + x)}{x(24 + 13x)}\right\}} - \dfrac{169x^2 \times 21(1 + x)}{24 + 13x} = 504(1 + x^2)$. Therefore $x = 3$, $y = 64$, $z = \frac{13}{8}$, and $w = 42$; hence the progressions are 42, 126, 378, and 64, 104, 169.

Ingenious solutions to all the questions in the Youth's Department were received from Masters R. Anderson, pupil at the Rev. Dr. Inchbald's Academy, Doncaster; Charles Bartholomew, Woodhouse-Grove Seminary; G. Parker, Stonehouse, near Plymouth: W. Bennett, Plymouth-Dock; Henry Ward, and C. H. Pigot, Stafford.

Master William Pickup, pupil in Mr. H. Lightbown's Seminary, Ainsworth-Street, Blackburn, answered 1, 2, 4 and 5.

Master Joseph Sharp answered 1 and 4.

Master James Bramwell, Trinity Church School, Preston, answered the 4th question.

Master C. Macauley, Hope School, Liverpool, answered the 2d question.

ANSWERS

TO THE

MATHEMATICAL QUESTIONS

Proposed in the Fourth Number of the Third Volume.

Six numbers of the Leeds Correspondent are now and will be hereafter regularly offered as a prize, to be adjudged BY LOT, to one Gentleman out of those who may give true solutions to the Prize Question in each number.

Amicus, who has transmitted the only solution we have received to the Prize Question in this Number, will have the goodness to apply, either personally or by letter, to Mr. John Heaton, Bookseller, Briggate, Leeds, and he will receive six Copies of this Number gratuitously, as the regular prize, which he has gained without a competitor.

(232). *By* Plus Minus.

A lovely young damsel, the pride of the plain,
Is courted by Billy, an amorous swain.
But Billy, (though handsome, and facile his tongue,)
She says, is too old, and that she is too young.
From the data* below then let it be told,
If the damsel's too young or her lover too old.

$$\text{Given} \left\{ \begin{array}{l} x^6 + xy^5 + x^5y + y^6 = 8301256384 \\ x^4 - x^3y + x^2y^2 - xy^3 + y^4 = 2159536 \end{array} \right\}$$

Where x denotes the damsel's age, and y her lover's.

By C. Bartholomew, *and* W. Shepherd.

Dividing the first equation by the second we get $(x+y)^2 = 62^2$, or $x + y = 62$ (No. 3.) From the fourth power of the third take the second, and we have $5x^3y + 5x^2y^2 + 5xy^3 = 12616800$, or $x^3y + x^2y^2 + xy^3 = 2523360$ (4.) Add the second to the fourth and extract the root, and we have $x^2 + y^2 = 2164$ (5).

From the square of the third take the fifth, and there remains $2xy = 1680$, or $4xy = 3360$ (6). This taken from the square of the third leaves $(y - x)^2 = 22^2$, or $y - x = 22$. But $y + x = 62$, (3) therefore, by adding and subtracting, we find $x = 20$, and $y = 42$.

By Mr. J. BAINES.

Divide the first equation by the second, and we have $x^2 + 2xy + y^2 = 3844$, or $x + y = 62$. From $(x + y)^4 = 62^4$ subtract the second given equation, and there results $5x^3y + 5x^2y^2 + 5xy^3 = 12616800$, or $xy(x^2 + xy + y^2) = 2523360$. From $xy(x^2 + 2xy, + y^2 = 3844xy$ subtract $xy(x^2 + xy + y^2) = 2523360$, and we obtain $x^2y^2 - 3844xy = -2523360$; which solved gives $xy = 840$; hence $y - x = 22$, $x = 20$ and $y = 42$ years.

Such unions, I am sure, will never do!
Gay blooming twenty link'd with forty-two
Is not congenial in the marriage state:
Therefore, Oh damsel! choose another mate.
This doleful match will cause thy tears to flow,
As much, I fear, as leading Apes below.

By OCTAGINTA, *and* Mr. J. JERWOOD.

When Nobles of *sixty* have frequently been
United in wedlock to girls of *sixteen*,
Why may not poor Billy be suffer'd to woo
The sweet girl of *twenty*—when he's *forty-two*?

Elegant Poetical or Algebraical solutions to this question were transmitted by Messrs. Macauley, Ryley, Hattersley, Stringer, Longbottom, Holt, Bartholomew, Jervis, Clay, Lytham, and Settle.

(233) *By Mr. W.* ELEY, *Rolleston Free-Grammar School, near Burton-on-Trent.*

In a plane triangle there are given, the base AB = 20, and the perpendicular DC = 8, to find the angle ACB when the greatest.

By Mr. JAMES JERWOOD.

It has been proved, (vide quest. 660, Ladies' Diary,) that of all triangles having the same given base and perpendicular, the Isosceles has the greatest vertical angle. Hence the $\angle$ ACB is easily found, for AD $\div$ CD $=$ nat. tang. $\angle$ ACD $= 51^\circ\, 20'\, 24''$, the double of which, or $102^\circ\, 40'\, 48'' = \angle$ ACB, the angle required.

Solutions were received from Messrs. Macauley, Hattersley, Baines, Ryley, Stringer, Holt, Bartholomew, Shepherd, Weight, Jervis, Clay, Lytham, and Settle.

(234) *By Mr.* JOHN *BAINES, Doncaster.*

Find an approximate value of the infinite series $\frac{1}{1^3} + \frac{1}{2^3} + \frac{1}{3^3} + \frac{1}{4^3}$, &c. by the method of Increments.

By Mr. CHARLES HOLT.

Let n represent the number of terms, and s their sum; then the nth term will be $\frac{1}{n^3}$, and the $(n+1)$th term, or $s_{,} = \frac{1}{(n+1)^3}$; put $n + 1 = x$, or $n = x - 1$; then $s = \frac{1}{(n+1)^3} = \frac{1}{x^3} =$ (by transformation) $\frac{1}{xx^1x^2}$ $+ \frac{3x_{\backslash}}{x\ldots x^3} + \frac{11x_{\backslash}^2}{x\ldots x^4} + \frac{50x_{\backslash}^3}{x\ldots x^5} + \frac{274x_{\backslash}^4}{x\ldots x^6} +$ &c.; then by taking the integral $s = c - \frac{1}{2x'xx^1} - \frac{3}{3x\ldots x^2} - \frac{11x_{\backslash}}{4x\ldots x^3} - \frac{50x_{\backslash}^2}{5x\ldots x^4} - \frac{274x_{\backslash}^3}{6x\ldots x^5}$ + &c. Now, when $s = 0$, it is evident that $n = 0$, $x = 1$, and (always) $x' = 1$; but under this assumption the series has too slow a convergency; therefore find the sum of any number of terms, of the given series ; for instance, find the sum of ten terms, which is $1.197531984 = c - \frac{1}{2.11.12} - \frac{3}{3.11.12.13} - \frac{11}{4.11\ldots14} - \frac{50}{5.11\ldots15} - \frac{274}{6.11\ldots16} -$ &c. $= c - .003787878 - .000582750 - .000114468 - .000027750 - .000007920 - .000002570 - .000000925 - .000000363 -$ &c. $= c - .004524624$. Hence $c = 1.202056608$ nearly, or $c = 1.202056608 + \frac{1026576}{10x\ldots\ldots x^9} +$ &c. truly, (the intermediate terms are summed between,) where $x = 11$. Consequently $s = \frac{1}{1^3} + \frac{1}{2^3} + \frac{1}{3^3}$ + &c. $= 1.202056608 +$ &c. $- \frac{1}{2.x'xx^1} - \frac{3}{3.x\ldots x^2}$ — *&c.* will be an approximate value of the series as required.

If the number of terms whose sum is required be many or infinite, then x must be large or infinite, and 1.202056608, in this case, will evidently be the sum nearly.

Remark, $s = 1.202056608\ (= c) + \frac{1026576x^7}{10.x\ldots\ldots x^9} +$ *&c.* $- \frac{1}{2.x'xx^1} - \frac{3}{3x\ldots x^2} -$ *&c.*, where it is to be observed that x in the first series is 11, but in the second $x = n + 1$.

This question was answered by Messrs. Macauley, Baines, Jerwood, Bartholomew, and Settle.

(235) By Mechanicus.

There is a certain clock which gains 5 minutes per day in consequence of the pendulum, which ought to vibrate 40 times in a minute, being too short. It is required to determine how many revolutions the nut of the screw part of the pendulum must be turned downwards to cause the clock to keep true time, supposing there are 10 rounds to an inch.

By Mr. W. SETTLE.

It readily appears from the question, that the pendulum must make $40\frac{5}{36}$ vibrations in a minute, to gain 5 minutes in 24 hours, for $24 \times 60 : 24 \times 60 + 5 :: 40 : 40\frac{5}{36}$; and as the lengths of pendulums (with the same force of gravity,) are reciprocally as the squares of their number of vibrations made in the same time, we have $(39\frac{1}{8} \times 60^2) \div 40^2 = 88.03125$ in. the length of a pendulum vibrating 40 times in a minute; and $(39\frac{1}{8} \times 60^2) \div (40\frac{5}{36})^2 = 87.42309$ inches, the length of a pendulum vibrating $40\frac{5}{36}$ times in a minute. Their difference $= .60816$ parts of an inch, at 10 rounds per inch, gives 6.0816, the number of rounds the nut of the screw should be turned downwards to make the clock keep true time as required.

By MR. JAMES JERWOOD, *and* J. LONGBOTTOM, *Bradford.*

By the law of pendulums $40^2 : 60^2 :: 39\frac{1}{8} : 88.03125$ in. the length of the pendulum that vibrates 40 times in a minute; and since the pendulum in the question gains 5 minutes in 24 hours, it gains 12.5 seconds in a hour; consequently the numbers of vibrations made by it when of a proper length and when too short, are as 3600 : 3612.5. Therefore as $3612.5^2 : 3600^2 :: 88.03125 : 87.42316$ inches. Hence the pendulum is $88.03125 - 87.43216 = .60809$ inches too short, and its screw part must be turned 6.0809 revolutions downwards to make it vibrate 40 times in a minute.

Solutions to this question were received from Messrs. Baines, Ryley, Hattersley, Ogden, Holt, Weight, Clay. Jervis, and Shepherd.

(236) *By Mr. S. RYLEY, Leeds.*

In the second solution to the 142d Question of this work, it is asserted that $\frac{rs}{m} \times \left\{ \frac{2a}{m} \left[1 - \sqrt{1 - \frac{mx}{a}} \right] \right.$

$\left. - x \right\}$ is equal to the sum of the series $rs \times \frac{x^2}{4a} + \frac{mx^3}{8a^2} + \frac{5m^2x^4}{64a^3} + \frac{7m^3x^5}{128a^4} +$ &c. Required the proof.

By Mr. John Baines.

First, $\sqrt{\left[1 - \frac{mx}{a}\right]}$ being expanded into a series becomes $1 - \frac{mx}{2a} - \frac{m^2x^2}{8a^2} - \frac{m^3x^3}{16a^3} - \frac{5m^4x^4}{128a^4} -$ &c. This being subtracted from 1, and the remainder multiplied by $\frac{2a}{m}$, gives $x + \frac{mx^2}{4a} + \frac{m^2x^3}{8a^2} + \frac{5m^3x^4}{64a^3}$ + &c. From this last series subtract x, and multiply the remainder by $\frac{rs}{m}$, we have (reserving rs as a common multiplier,) $rs \times \left[\frac{x^2}{4a} + \frac{mx^3}{8a^2} + \frac{5m^2x^4}{64a^3} + \text{\&c.}\right]$, as was to be proved.

This question was also answered by Messrs. Ryley, Hattersley, Longbottom, Holt, Bartholomew, Shepherd, Weight, Clay, and Settle.

(237) *By Mr. H. Lightbown.*

To find the fluent of $\frac{xx'\sqrt{2rx+x^2}}{r+x}$

By Mr. John Macauley.

Put $r + x = z$; then $x' = z'$, and the above expression becomes $\frac{zz' - rz'\sqrt{(z^2 - r^2)}}{z}$. Multiply above and below by $\sqrt{(z^2 - r^2)}$, and we have $z'\sqrt{(z^2 - r^2)}$

$-\dfrac{rzz'}{\sqrt{(z^2-r^2)}}+\dfrac{r^3z'}{\sqrt{(z^2-r^2)}}$. The fluent of the first, of $z'\sqrt{(z^2-r^2)}$, is $\frac{1}{2}z\sqrt{(z^2-r^2)}-\frac{1}{2}r\times$ hyp. log. $[z+\sqrt{(z^2-r^2)}]$; that of $\dfrac{rzz'}{\sqrt{(z^2-r^2)}}$ is $r\sqrt{(z^2-r^2)}$; and that of $\dfrac{r^3z'}{\sqrt{(z^2-r^2)}}$ is $r\times$ cir. arc, rad. r, and sec. z. Therefore by collecting these into one sum and writing $r+x$, instead of z, we have $\frac{1}{2}(r+x)\sqrt{(2rx+x^2)}-\frac{1}{2}r^2\times$ hyp. log. $[r+x+\sqrt{(2rx+x^2)}]-r\sqrt{(2rx+x^2)}+r\times$ cir. arc, rad. r, and sec. $(r+x)$ for the required fluent.

By Mr. W. Stringer.

Put $r+x=z$, and the proposed fluxional expression becomes $\dfrac{(z-r)z'\sqrt{z^2-r^2}}{z}=\dfrac{z^2z'}{\sqrt{z^2-r^2}}-\dfrac{r^2z'}{\sqrt{z^2-r^2}}-\dfrac{rzz'}{\sqrt{z^2-r^2}}+\dfrac{r^3z'}{z\sqrt{z^2-r^2}}$; which belong to well-known forms.

Taking the fluent of each term, and connecting the whole, we obtain $\frac{1}{2}z\sqrt{z^2-r^2}-\frac{1}{2}r^2\times$ hyp. log. $(z+\sqrt{z^2-r^2})-r\sqrt{z^2-r^2}+r^2\times$ arc, (sec. $=\dfrac{z}{r}$, and radius $=1$,) or by connecting the first and third terms, we get $(\frac{1}{2}z-r)\sqrt{z^2-r^2}-\frac{1}{2}r^2$ hyp. log.$(z+\sqrt{z^2-r^2})+r^2.$ arc, (sec. $=\dfrac{z}{r}$, rad. $=1$,) the fluent required.

By Messrs. J. Baines, S. Ryley, Plus Minus, and H. Clay.

Assume $z=\sqrt{(2rx+x^2)}$, then $x=\sqrt{(r^2+z^2)}-r$, $x'=\dfrac{zz'}{\sqrt{(r^2+z^2)}}$, $xx'=zz'-\dfrac{rzz'}{\sqrt{(r^2+z^2)}}$ Hence

$F' = \frac{z^2 z'}{\surd(r^2 + z^2)} - \frac{r z^2 z'}{r^2 + z^2} = \frac{z^2 z'}{\surd(r^2 + z^2)} - rz' + \frac{r^3 z'}{r^2 + z^2}$, and $F = \frac{z}{2}\sqrt{r^2 + z^2} - \frac{1}{2}r^2 \times$ *h.l.* $[z + \surd(r^2 + z^2)] + r \times$ circ. arc, radius r, and tangent $z - rz$. Or, by restoring the value of z, we have $F = \left(\frac{r + x}{2}\right) \sqrt{2rx + x^2} - \frac{1}{2}r^2 \times$ hyp. log. $[r + x + \surd(2rx + x^2)] + r \times$ (cir. arc to rad. $= r$, and tan. $= \surd(2rx + x^2) - r\surd 2rx + x^2)$ the fluent required.

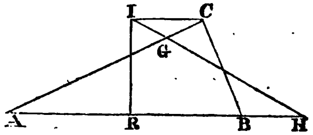
⁂ See Art. 45 and 122, Vince's fluxions, or the Table of Fluents, in Barlow's Mathematical Tables, Forms 28 and 31.

This question was also answered by Messrs. Winward, Holt, Weight, Wright and Settle.

(237) *By Mr. W.* STRINGER, *Hallam, near Sheffield.*

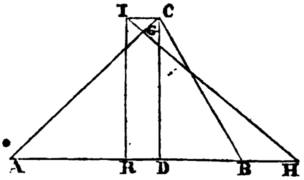
Let ACB be a plane triangle, the base AB being bisected in R, by the perpendicular RI, which cuts CI a parallel to BR in I: take CG in AC equal to half the difference of the sides AC, BC; and let IG, AB be produced to meet in H. I say $2AB \cdot AH = (AC + BC)^2$. Required the demonstration.

By Mr. JOHN OGDEN.



Suppose ACB the triangle, and the lines drawn as per question. Then AG = half the sum of the sides, and CI equal half the difference of the segments of the base made by the perpendicular. Then by a well known elementary property AB : 2AG :: 2GC : 2CI :: 2AG : 2AH, because the triangles GCI and GAH are similar. therefore $2AB \cdot AH = 4AG^2 = (AC + BC)^2$. Q.E.D.

By Mr. Jesse Winward *and* Mr. H. Clay.



The diagram being drawn as enunciated in the question, drop the perpendic. CD; then, by known properties, AG $= \frac{1}{2}$(AC + CB), and IC $= \frac{1}{2}$(AD — DB); and by a familiar proposition, AB : 2AG :: CG : CI; and, per similar triangles, IGC, AGH, CG : CI :: AG : AH. Hence, per equality of ratios, AB : 2AG :: AG : AH; therefore AB . AH = 2AG . AG $= 2\text{AG}^2$, or 2AB . AH $= 4\text{AG}^2 = (\text{AC} + \text{CB})^2$. Q.E.D.

This question was also answered by Messrs. Baines, Ryley, Stringer, Longbottom, Holt, Bartholomew, Shepherd, Settle.

(238) *By Mr. C. Waterhouse.*

Find such general values of u and w as shall make the formula $(u^2 - w^2) . (u^2w^2 - 1)$* a rational square.

* See page 151 of the Key to Bonnycastle's Algebra, 10th Edition.

By Mr. J. Baines *and* Mr. H. Clay.

Put $u = r + 3$, and $w = r + 1$; then by substitution $(u^2 - w^2) \times (u^2w^2 - 1)$ becomes $4(r + 2) . (r^4 + 8r^3 + 22r^2 + 24r + 8)$, to be made a square. But this expression is divisible by $4(r + 2)^2$, the quotient being $r^3 + 6r^2 + 10r + 4$, to be made a square. Assume $-\frac{1}{16}x^2 + \frac{5}{2}x + 2 =$ its root, and we get $\frac{1}{256}r^4 - \frac{5}{16}r^3 + 6r^2 + 10r + 4 = r^3 + 6r^9 + 10r + 4$, or $r = 336$; hence $u = 339$, and $w = 337$, two numbers that will answer. Again, assume $(\frac{5}{2}r + 2)^2 = 6\frac{1}{4}r^2 + 10r + 4 = r^3 + 6r^2 + 10r + 4$, and we obtain $r = \frac{1}{4}$; hence $u = \frac{15}{4}$, and $w = \frac{5}{4}$. two other numbers that will answer.

By the Proposer.

Put $u = \dfrac{r^2 + s^2}{(r^2 - s^2)w}$ then will $u^2w^2 - 1 = \dfrac{r^2 + s^2}{(r^2 - s^2)^2}$

$- 1 = \frac{4r^2s^2}{(r^2 - s^2)^2}$, and now we have $u^2 - w^2$ or $\frac{(r^2 + s^2)^2}{(r^2 - s^2)^2\, w^2} - w^2$ to make a square; which last expression when multiplied by $(r^2 - s^2)^2 w^2$ becomes $(r^2 + s^2)^2 - w^4(r^2 - s^2)^2$ to make a square. Put $w = b - 1$: which value of w being substituted in the last formula makes it $= (r^2 - s^2)^2 \times (- b^4 + 4b^3 - 6b^2 + 4b) + 4r^2s^2$. Assume $= \left\{ 2rs + \frac{b(r^2 - s^2)^2}{rs} - \left[\frac{6b^2(r^2 - s^2)^2}{4rs} + \frac{b^2(r^2 - s^2)^4}{4r^3s^3} \right] \right\}^2$, and by leaving out like terms on each side of the equation we get $4b^3(r^2 - s^2)^2 - b^4(r^2 - s^2)^2 = - \frac{12b^3r^2s^2(r^2 - s^2)^4 + 2b^3(r^2 - s^2)^6}{4r^4s^4} + \left[\frac{6b^2r^2s^2(r^2 - s^2)^2 + b^2(r^2 - s^2)^4}{4r^3s^3} \right]^2$; and by multiplying this equation by $\frac{16r^6s^6}{b^3(r^2 - s^2)^2}$ there will be $64r^6s^6 - 16br^6s^6 = - 48r^4s^4(r^2 - s^2)^2 - 8r^2s^2(r^2 - s^2)^4 + b[6r^2s^2(r^2 - s^2) + (r^2 - s^2)^3]^2$. Hence $b = \frac{64r^6s^6 + 48r^4s^4(r^2 - s^2)^2 + 8r^2s^2(r^2 - s^2)^4}{16r^6s^6 + [6r^2s^2(r^2 - s^2) + (r^2 - s^2)^3]^2}$, $w = b - 1 = \frac{48r^6s^6 + 12r^4s^4(r^2 - s^2)^2 - 4r^2s^2(r^2 - s^2)^4 - (r^2 - s^2)^6}{16r^6s^6 + [6r^2s^2(r^2 - s^2) + (r^2 - s^2)^3]^2}$ and $u = \left\{ \frac{r^2 + s^2}{r^2 - s^2} \right\} = \frac{1}{w} \times \frac{r^2 + s^2}{r^2 - s^2} \times \left(\frac{16r^6s^6 + [6r^2s^2(r^2 - s^2) + (r^2 - s^2)^3]^2}{12r^4s^4(r^2 + s^2)^2 - 4r^2s^2(r^2 - s^2)^4 - (r^2 - s^2)^6]} \right)$ as required.

Solutions to this question were received from Messrs. Ryley, Hattersley, Holt, Jerwood, Shepherd, and Settle.

(239) *By Mr. W. Wright, Hull.*

Find three numbers, ad libitum, such that their sum shall be a square, and any one of them being increased by the square of their sum shall be a square.

By Mr. S. RYLEY.

Let $x + y + z + \&c. = p^2$. Then $x = p^2 - y - z - \&c.$; and, per question,

$$\begin{aligned} &p^4 + p^2 - y - z - \&c. = \Box, \\ &p^4 + y = \Box, \\ &p^4 + z = \Box, \\ &\&c. + \&c. = \&c. \end{aligned}$$

$$\text{Let } \begin{cases} y = ap^2, \\ z = bp^2, \\ \&c. = \&c. \end{cases}$$

$$\text{Then } \begin{cases} p^2 + 1 - a - b - \&c. = \Box, \\ p^2 + a = \Box, \\ p^2 + b = \Box, \\ \&c. + \&c. = \&c. \end{cases}$$

$$\text{Make } \begin{cases} a = 2pq + q^2, \\ b = 2pr + r^2, \\ \&c. = \&c. + \&c. \end{cases}$$

then will all the formulas become squares except the first, which transforms into $p^2 + 1 - (2pq + q^2 + 2pr + r^2 + \&c.\ \&c.) = \Box$. Make $2p = 2pq + q^2 + 2pr + r^2 + \&c.$, or $p = \dfrac{q^2 + r^2 + \&c.}{2 - 2q - 2r - \&c.}$.

EXAMPLE 1. No. terms $= 2$; then $p = \dfrac{q^2}{2 - 2q}$. Let $q = \frac{1}{3}$, then $p = \frac{1}{12}$, $a = \frac{1}{6}$, $y = \dfrac{1}{144 \times 6}$, and $x = \dfrac{5}{144 \times 6}$.

EXAMPLE 2. No. terms $= 3$, then $p = \dfrac{q^2 + r^2}{2 - 2q - 2r}$. Let $q = \frac{1}{4}$ and $r = \frac{1}{8}$, then $p = \frac{1}{16}$, $a = \frac{1}{32}$, $b = \frac{3}{32}$, $y = \dfrac{1}{16^2 \times 32}$, $z = \dfrac{3}{16^2 \times 32}$, and $x = \dfrac{28}{16^2 \times 32}$.

EXAMPLE 3. When No. terms $= 4$, then $p = \dfrac{q^2 + r^2 + s^2}{2 - 2q - 2r - 2s}$. Let $q = \frac{1}{3}$, $r = \frac{1}{6}$, and $s = \frac{1}{12}$, then $p = \frac{7}{40}$, $a = \frac{82}{360}$, $b = \frac{31}{360}$, $c = \frac{13}{360}$, also $y = \dfrac{7^2 \times 82}{40^2 \times 360}$, $z = \dfrac{7^2 \times 31}{40^2 \times 360}$, $v = \dfrac{7^2 \times 13}{40^2 \times 360}$, and $x = \frac{7^2 \times 234}{40^2 \times 360}$. Hence the law of continuation is manifest.

By the Proposer.

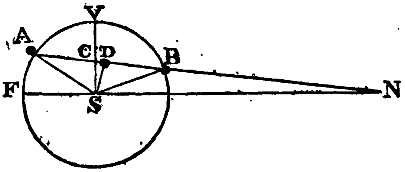
SOLUTION.—Let $(v^2-1) \times r^4$, $(x^2-1) \times r^4$, $(y^2-1) \times r^4$, $(z^2-1) \times r^4$, &c. represent the numbers sought, and r^2 their sum; then $(v^2-1) \times r^4 + r^4 = v^2r^4$, $(x^2-1) \times r^4 + r^4 = x^2r^4$; $(y^2-1) \times r^4 + r^4 = y^2r^4$, $(z^2-1) \times r^4 + r^4 = z^2r^4$, &c. are all squares, and it remains to make $(v^2-1) \times r^4 + (x^2-1) \times r^4 + (y^2-1) \times r^4 + (z^2-1) \times r^4 + \&c. = r^2$. Divide by r^2, then $(v^2 + x^2 + y^2 + z^2 + \&c. \text{ to } n) \times r^2 = 1$, or $z^2 = \frac{1}{v^2 + x^2 + y^2 + z^2 + \&c. \text{ to } n} = \square$. Its numerator is 1 already, and, to make the denominator such, make it $= (v+p)^2 = v^2 + 2vp + p^2$, from which $v = \frac{v^2 + x^2 + y^2 + z^2 + \&c. \text{ to } n}{2p}$. Where v, x, y, z, &c. may be taken at pleasure so as to render v affirmative.

Solutions to this question were also received from Messrs. Holt, Bartholomew, Shepherd, and Settle.

(240) *Prize Question, by* AMICUS.

The transit of the planet Mercury over the sun's disc, *visible in England*, will happen in May 1832, at the descending node. It is required to compute the times of the beginning, middle, and end of the transit for the meridian of the Royal Observatory at Greenwich.

By AMICUS.



The Elements of the Sun as computed from M. De Lambre's Tables for mean noon, May 5th, 1832, are as follows:—

⊕'s Longitude	7^s 14° 57′ 25″.48
☉'s Horary motion in Longitude	145″.08
☉'s Semidiameter	15′ 52″.4
⊕'s Distance from the ☉, the mean distance being unity	1.00952

From the Tables of the Planets' Motions the Elements of Mercury's Place at the same time are found to be as below:—

☿'s	Longitude	7^s 14° 57′ 55″
	Distance from the node ...	1° 22′ 50″
	Horary motion in Latitude	54″.16
	Horary motion in Longitude	439″.46
	Heliocentric Latitude ...	10′ 5″
	Radius Vector or Distance from ☉ the mean dist. being unity	.45112

Hence the Distance of ☿ from ⊕ .55830

Now ☿'s Hor. Mot. — ☉'s Hor. Mot. = 294.38 : 1 hour :: ☿'s longitude — ⊕'s longitude = 30″.79 : 6′ 16″. Hence the true conjunction of ☿ and ⊕, will be on May 4d. 23h. 53 min. 44 sec. A.D. 1832 when the true Longitude of ⊕ = 7^s 14° 57′ 10″.3 = long. ☿.

Again as 1h : 54″.16 :: 6′ 16″ : 5″.6, which added to 10′ 5″ gives 10′ 10″.6, the heliocentric lat. of ☿ at the ecliptic conjunction. And as .5583 : .45112 :: 10′ 10″.6 : 8′ 13″.3, the geocentric lat. of ☿ at the Ecliptic conjunction which being less than the semi-diameter of ☉ = 15′ 52″.4, indicates that there must be a transit of Mercury over the sun at the earth's centre, and consequently somewhere upon its surface.

Let ABF represent the sun's disc, S its centre, FSN a portion of the ecliptic, perpendicular to which draw SC = 8′ 13″.3, then C will be the apparent place of ☿ in conjunction. Let ABN represent the orbit of ☿ as seen from the ⊕, on which demit the perpendicular SD bisecting the chord AB in the point D: then D will be the middle of the transit.

Now as .5583 : .45112 :: 294″.38 : 237″.92, the difference of the horary motion of ☿ and ☉ seen from the ⊕ in longitude; and as 294″.38 : 54″.16 :: rad. : tan. 10° 25′ 30″ = the angle N, which ☿'s relative orbit makes with the ecliptic. In the right-angled plane triangle SDC, which is similar to NSC, rad. : sine ∠ CSD = 10° 25′ 30″ :: SC = 8′ 13″.3 : DC = 89″.26. And co-sine inclination 10° 25′ 30″ : rad. :: 237″.92 : 241″.92 = the horary motion of ☿ in his relative orbit NA. Hence, as 241″.92 : 1h. :: DC = 89″.26 : 22′ 8″ = time of describing DC, which added to 4d. 23h. 53 min. 44 sec., the time when ☿ arrives at C, gives 5d. 0h. 15 min. 52 sec. for the middle of the transit.

Again, rad.: co-sine inclination = 10° 25′ 30″ :: SC = 8′ 13″.3 : 8′ 5″.15 = SD, the nearest distance of ☿ from the ⊙'s centre. Now, in the right angled △ ADS, AS = 15′ 52″.4 and DS = 8′ 5″.15 are given to find AD, which is most readily done by logarithms thus—

Log. AS + SD = log. (952″.4 + 485″.15) = 3.157623
Log. AS — SD = log. (952″.4 — 485″.15) = 2.669549
2)5.827172
Log. AD = 819″.57 2.913586

Lastly, to find the time of describing AD, say as 241″.92 : 1h :: 819″.57 : 3h. 23 min. 15 sec.; which subtracted from and added to the time when ☿ arrives at D, give 4d. 20h. 52 min. 37 sec. and 5d. 3h. 39 min. 7 sec., for the beginning and end of the transit, mean time according to the tables. Hence at the Royal observatory at Greenwich the Tables give the times of the transit of Mercury over the sun's disc on May 5, 1832, as below—

Beginning	at 8h. 52 min. 37 sec.	A. M.
Middle	at 0h. 15 min. 52 sec.	P. M.
End	at 3h. 39 min. 7 sec.	

Total duration 6h. 46 min. 30 sec.

⁂ No regard is here paid to the effect produced by the menstrual parallax, it being inconsiderable when compared with the errors of the Tables.

This solution being the only one we have received to the Prize Question, entitles Amicus to Six Numbers of the Leeds Correspondent without a Competitor.

THE

LEEDS CORRESPONDENT,

A

Literary, Mathematical, and Philosophical Miscellany.

> Tarda fluunt ingrataque tempora, quæ spem
> Consiliumque morantur agendi gnaviter id, quod
> Æque pauperibus prodest, locupletibus æque;
> Æque neglectum pueris senibusque nocebit.
>
> HORAT.

No. II. APRIL, 1822. VOL. IV.

REVIEW.

The Life of WILLIAM HEY, *Esq., F. R. S., Member of the Royal College of Surgeons, in London; Honorary Member of the Royal College of Surgeons in Ireland; of the Royal Medical Society of Edinburgh; and of the Literary and Philosophical Society of Manchester; and late senior Surgeon of the General Infirmary of Leeds.*——By JOHN PEARSON, F. R. S. F. L. S. M. R. I. *Member of the Royal College of Surgeons in London, &c. &c.* London, 8vo. pp. 667.

We congratulate our readers on the appearance of this very able and generally impartial piece of biography, the subject of which conferred on the town of Leeds, during a residence of nearly seventy years, the highest honour and the most durable benefits. In relation to Mr. Hey, there was a "HOUSE OF MERCY" the sight of which, according to his own expressive phrase, "was one of the daily sources of consolation that attended his declining years;" and other edifices might be pointed out, the occasional sight of which might, though in a minor degree, have proved similar sources of comfort to the benevolent heart with whom they principally originated. Among these may be reckoned St. Paul's Church, the House of Recovery for Fever Patients, the Lancasterian School, and the [then unfinished] Hall of the Leeds Literary and Philosophical Society. One of the most conspicuous omissions in Mr. Pearson's very excellent production, is the neglect of all notice of Mr. Hey's active exertions in the formation of the last-named learned institution, over whose auspicious commencement and rising importance this highly gifted individual watched with all the solicitude of a scientific parent. Indeed, his attendance on its committees, and his judicious assistance and advice in the revision of its fundamental laws, may be reckoned among the last public acts of his life, and were, on that account, entitled to a distinct record in the biographic page.

In our boyish days Mr. Hey was a venerable man, on account of his age, his literary attainments, his well-earned professional celebrity, and his unassuming piety. In those unpleasant and now happily-forgotten feuds, which, some twenty years ago, disturbed the classic peace of the Free Grammar School in Leeds, we recollect personally to have received from this great man tokens of high approval for our conduct on that most trying occasion: And, a few years afterwards, it was no small gratification to our youthful yet retiring spirit, to learn, from our ever-honoured and most accomplished preceptor, the late Rev. Joseph Whiteley, that a manuscript volume of Bishop Hungerford's Greek Exercises, (which, at his request, we had left for his learned correction and revision,) having been casually beheld by Mr. Hey, had elicited from him expressions of admiration for its accuracy, and other properties which he was pleased to point out in its execution. Not twelve months before his death, in a private conversation, we were favoured with some very interesting remarks from him on biblical literature, and were surprised at the extent and profundity of his knowledge, particularly in relation to the comparative excellence of the different Latin versions of the Holy Scriptures. With the exception of these and a few other opportunities of personal acquaintance, our knowledge of the late William Hey, Esq. was, in common with that of many others, only slight, and it was our lot to view his successful career at a respectful distance. Yet, on comparing our first and last interviews together, we can from our own impressions bear testimony to the justice of the distinction which Mr. Pearson has noticed in these words of a correspondent: "In the latter periods of his life,......... instead of indulging his natural disposition to abstraction and silence, he became free, open, and communicative; ...... and his wary and solemn reservedness was changed into an easy and agreeable loquacity."

Mr. Pearson's intelligent introductory remarks occupy, to good purpose, 70 pages of the volume. We may notice, at some more favourable opportunity, what he has so well observed concerning the influence of religion on the human mind and character, in all situations; the beneficial effects of dialectics, and of the much-decried science of metaphysics, on a well-ordered mind; the alleged infidelity of the Faculty; the questionable nature of this deistical maxim—"the study of nature leads up to nature's GOD;" the culpable negligence of parents in the kind of early education which they bestow on their offspring; the many noble exceptions to imputed Deism in the medical profession; and the improvement in the conduct and manners of its members. The mode in which these and similar topics are discussed, exhibit strong traces of a vigorous, chaste, liberal, and enlightened mind; and a perusal of the whole work will convince any reader of discernment, that Mr. Hey has found in Mr. Pearson, a biographer in every respect worthy of his great reputation and transcendent excellences.

We cannot, however, approve of the division of the work into three parts—"The Professional Life, Remarks on the Professional Writings, and the Moral and Social Life."—The Remarks on the Professional Writings appear to great disadvantage in their present position: They would have been placed to much better effect in one of the many excellent Medical Journals published in the Metropolis, the conductors of which would have appreciated in a proper manner those critical details into which, as a professional gentleman, Mr. P. has considered it his duty to enter. As they now stand, they form an insuperable objection to the general circulation of the book, on account of the additional space which they occupy in it, the consequent increase of price, and the nature of the subjects which are there discussed. When all the copies of the first edition are sold off, it will become an object worthy of some consideration with the author and the friends of the deceased, whether this work, professedly biographic, is to remain in its present form, strictly as a GENTLEMAN's book both *secundum systema naturæ, et secundum pretium;* or whether the professional, and the moral and social life, may not be most commodiously united, and published in a portable form and at a reasonable price, without the professional remarks against which we have objected. The whole of the matter might in that case be comprised in a neat and agreeable duodecimo volume, not exceeding six shillings in price, and thus within the reach of the poorer classes of the community, to many of whom it would be greatly endeared from the pleasing recollections which they entertain of the honoured subject of it, and to others of them the principles which it exhibits would prove of incalculable service.

The following extracts from Mr. Pearson's Introductory Remarks will ensure his work a favourable reception from every man of candour.

When individuals appear in the common circle of life and business, adorned with religion, philosophy, morality, science and taste, this noble alliance of great and good qualities commands respect, and excites admiration; and the contemplation of men by whom human nature is thus raised above its ordinary level, is calculated to inspire the ingenuous mind with purposes of treading in the same path, and desires of participating in the honours and advantages with which distinguished merit is frequently rewarded.

An ambition actuated and controlled by the love of excellence, in which the desire of superiority is subordinate to the wish of eminence in virtuous and useful attainments, will be in little danger of urging the mind into culpable excesses, or betraying it into a lawless disregard of the just claims of competition. This aspiring and dangerous passion, thus chastised and reduced into order, may be excited and directed by a view of the character of those to whom honourable distinctions have been awarded, as a debt owing to meritorious diligence and superior public desert; and thus regulated, it will not infringe the claims of benevolence, nor be at variance with the peace and welfare of society.

The friends of Mr. Hey conceived and hoped, that introducing into public view the life of a man in whom superior intelligence, considerable attainments, professional eminence, were combined with a consistent and uniform recognition of religious, moral, and social obligations, matured into habit, and operating with the force and constancy of a living principle, might be favourably received, and contemplated with advantage. It is not presented as a model to be exactly copied; since One only of all that have been invested with human nature, could "leave us an example, that we should tread in his steps." The records of our Saviour's life and conversation exhibit perfection neither impaired by frailty, nor obscured by infirmity; an elevated and refined humanity, incorporated with unsullied rectitude and spotless purity, the visible emanations of a holiness celestial and divine.

To say, that Mr. Hey was not faultless, is merely to say that he was a man; whatever his faults may have been, I should find it more difficult, than the world might be disposed to credit, to enumerate than to conceal them; and of no man could it with greater truth be affirmed, than of him, "that most of his faults brought their excuse with them." The fidelity of Biography undoubtedly requires that the failings, as well as the virtues, should be fairly and honestly recorded; and no one would have exercised greater freedom and severity on Mr. Hey, than he would on himself; but, surely, the interests of truth do not demand a rigorous, inquisitorial perquisition after spots and blemishes too faintly coloured to shew themselves; this would be to imitate the painter who should employ a microscope to detect the pimples and inequalities of the countenance, that he might delineate it with the greater exactness. The great outlines, the prominent features of Mr. Hey's character, are truly and faithfully represented; they demonstrate the effects of divine grace on the heart and in the life of a man, subject to the like passions and exposed to the same temptations as ourselves; and they offer a bright and attainable example of the power and efficiency of religious principles, brought into operation, and maintained with uniformity, in the ordinary intercourse and occupations of a long and busy life.

The hope of contributing, in some degree, to the benefit of his professional brethren, and promoting the cause of Christianity in the world at large, has sustained and animated the Writer under the various disadvantages of his situation. He appears, therefore, before the public under less anxiety for his own reputation, than solicitude lest his insufficiency should be an occasion of frustrating or obstructing, that instruction which the bright example of Mr. Hey has bequeathed to posterity.

We now present our readers with an abridged sketch of Mr. Hey's life, both professional and social.

William Hey, the third son of Richard and Mary Hey, of the village of Pudsey, in the parish of Calverley, near Leeds, in the West Riding of Yorkshire, was born August 23, O. S. (September 3,) 1736. His father was a dry-salter, or dealer in several of the ingredients used in the manufacturing of cloth. His mother was the daughter of Jacob Simpson, Surgeon in Leeds, whose father, William Simpson, M. D., exercised his profession in the town of Wakefield, near Leeds.

When William Hey was about three years old, he was exposed to the danger of being burnt to death by his dress taking fire; but he was providentially rescued by a maid servant, who, with great presence of mind, enfolded him in her apron, and thus extinguished the flame. At the age of four years, as he was cutting a piece of string, the edge of the pen-knife being directed upwards towards his face, on dividing the string, the point of the knife penetrated his right eye and totally destroyed its power of vision. His father was much affected by the simplicity of his reply to a question respecting the sight of the injured eye: "He saw light," he said, "with one eye and darkness with the other." The left eye possessed the faculty of vision in great perfection, and he retained this power to a very late period of life; being able to read small print without the aid of glasses. During his childhood he was remarkable for his sprightliness and activity, engaging in all the sports common to children with great ardour and vivacity; and this vigour and animation of body and mind, remained with him and were conspicuous in all his pursuits, through every period of a long life. When he was between seven and eight years of age, he was sent, with his elder brother John to an academy at Heath, near Wakefield, which was superintended by Mr. Joseph Randall, who conducted it upon a large and liberal, though somewhat expensive plan. The late Dr. Dodgson, Bishop of Elphin, and the Rev. Mr. Sedgwick, late Head Master of the Free School at Leeds, were classical tutors. William Hey was particularly noticed by his tutor, Dr. Dodgson, who gave him a book as a testimony of his regard and approbation;—indeed, his unwearied application and persevering industry merited and gained the kind attentions of all his masters. When speaking on this subject, he has been heard to say, that he was never punished but once during the seven years that he remained at school, and the occasion of that was his not divulging (when monitor) the fault of a school-fellow. At Heath he acquired a taste for natural philosophy, by attending lectures given by one of the masters, on this subject; who, having a philosophical apparatus, illustrated his instructions by suitable experiments. In addition to his study of the classics, and attention to the usual employments of boys in such seminaries, he acquired a competent knowledge of the French language, which he spoke with much correctness and fluency. At this early period he displayed a great love of learning and science, which increased with his years, and was conspicuous through every subsequent period of his life. The assiduous care of the parents of William Hey to form his moral character was eminently successful; he was never known to utter a falsehood, and such was his dutiful and affectionate regard to them, that his sister cannot recollect his having been ever accused of a single act of disobedience to his father or mother. But the instructions of these worthy persons did not terminate in teaching him a sacred regard to truth in his words, fidelity and uprightness in his conduct, and the duty of cheerful obedience to themselves; they inculcated, both by precept and example, the important obligations of religion, the fear of God, the importance and advantage of public worship and of private devotion; and so strongly was his mind impressed by their injunctions on the subject of this duty, that on no occasion would he tolerate the omission of it. Habits of piety, formed thus early, lost none of their beneficial influence with his advancing years: his adult age was distinguished by self-government, temperance, purity, and a conscientious regard to his several duties; and over his more mature and declining years, the power of religion shed a bright and increasing influence, which actuated and adorned every subsequent period of his life, and conducted him through those various scenes of useful exertion, which procured for him a just veneration while living, and crowned his memory with honour.

At fourteen years of age he was placed as an apprentice with Mr. Dawson, Surgeon and Apothecary at Leeds. Having been designed for the medical profession from his infancy, he submitted to the wishes of his parents in adopting the study of medicine. Had his own inclination been consulted, he would have preferred going to sea; and he was induced to comply the more readily with the determination of his friends, in the hope of being, at some future period, the surgeon of a man of war.

During the time of his apprenticeship with Mr. Dawson, he never omitted the duty of private prayer, on rising in the morning and retiring at night. This custom exposed him to the scoffs and ridicule of his fellow-apprentice, who would introduce the servant boy into their bed-room to join with him in his mockery of this religious service; but William Hey was not to be intimidated into a dereliction of his pious habits by the impulse of shame, or the dread of contempt. He persevered steadily in his duty; and his firmness soon induced these inconsiderate young persons to desist from their improper behaviour towards him.

About this period he began to attend the evening prayers at the parish church, whenever his engagements would permit him; and here he met a little company of pious young men, with whom he soon formed an acquaintance.

Mr. Hey had not yet acquired a correct knowledge of the doctrines of Christianity; for, in a conversation with one of his young friends who was addressing him on the subject of disclaiming all merit, and relying solely on the mercy and grace of the Redeemer for salvation, he replied, "What! Are we not to do our duty?" That an objection of this nature should arise in the mind of a youth, who had not duly studied the representations made in the New Testament concerning the mediatorial office of our Saviour, is not extraordinary.

William Hey was at this period in the habit of retiring, at convenient opportunities, to study the Holy Scriptures, and digest what he read by serious meditation. On one of these occasions, when he was reading the fifth chapter of the second epistle to the Corinthians, his attention was forcibly arrested by the seventeenth verse; "If any man be in Christ, he is a new creature; old things are passed away; behold, all things are become new." In reflecting on these words, a series of considerations arose in his mind, which gave him new and more adequate conceptions of the nature and extent of christian piety. He acquired a more correct and practical understanding of his true state and condition; he saw and felt the necessity of an entire renovation in his heart and affections; he could no longer derive gratification from mixing in scenes of gaiety and amusement; the objects of ambition, vanity and pleasure, lost their seducing influence: his thoughts were now chiefly occupied and his affections engaged, by invisible and eternal realities; his conversation and manners indicated a deep concern for the welfare of his soul, which induced his less serious companions to withdraw from his society. Mr. Hey, in conversation with his intimate friends, sometimes remarked, that, on his first becoming seriously religious, "his mind was not so deeply impressed by a sense of the great evil of sin, as attracted by an apprehension of the beauty and excellency of holiness. He was much affected by contemplating the love of God manifested in the redemption of a sinful world by Jesus Christ, by the divine wisdom displayed in the several dispensations of providence and grace," &c. From this period he became the willing and consistent disciple of divine truth.

When he was about eighteen years of age he united himself to the people called Methodists, who were under the direction and superintendence of the Rev. John Wesley; and he continued in connexion with them between twenty and thirty years. The serious and forcible representations made by Mr. Wesley in his "Appeal to Men of Reason and Religion;" the zeal, fervour, persevering industry and success, with which he and his associates exerted themselves in communicating religious instruction to the poor, the ignorant, and the vicious, operated powerfully on the mind of Mr. Hey to induce him to become connected with this society of Christians. He did not conceive, that his admission as a member of the Methodist Society, implied any thing like a secession from the Established Church. To the Church of England he was always firmly and affectionately attached, from a deliberate and well-grounded persuasion of the soundness and purity of her doctrines, and a veneration for the elevated piety and spirituality of her excellent Liturgy. It may be likewise proper to remark, that, at this early period of Methodism, their chapels were never opened during the hours appointed for divine worship in the Establishment; that the members of their societies generally attended the service of the church regularly, and both the preachers and the people professed themselves to be conscientious members of the English Church. Mr. Hey would frequently express, in the subsequent periods of his life, the advantage he derived from attending the evening prayers at his parish church. "I often," said he, "look at the place where I was accustomed to sit, with great pleasure, and never can forget the happy moments I then enjoyed. The winter season was peculiarly pleasant to me; as the solemn gloom, which seemed rather increased by the few candles then lighted, tended to sober the mind, and excited a peculiar feeling not unfriendly to devotion. I was always sure of hearing two good sermons, one from a prophet, and another from an evangelist; consequently I never came empty away." The conduct of William Hey in Mr. Dawson's family was regular and consistent; he fulfilled the duties of an apprentice with exemplary fidelity; and the only fault then imputed to him was that of being "righteous overmuch." Mr. and Mrs. Dawson considered him as being unnecessarily precise and strict, and they suspected that the religious tenets which he had adopted were not a little tinctured with enthusiasm. On a particular occasion Mrs. Dawson undertook to expostulate with him on the subject of his religious sentiments, and endeavoured to convince him of the error of his opinions. He listened with respectful patience to all that she had to propose; and the opportunity which this remonstrance presented to him of exhibiting to Mrs. Dawson the views he entertained of the nature of true religion, was very agreeable to him. His replies to her were calm and conciliating; and on this as on many subsequent occasions, he referred to the Articles and Liturgy of our Church, as incontestable evidences that the principles he maintained were in perfect agreement with those for which our Reformers had contended, as the pure doctrine of the Sacred Writings. He read to her, occasionally, the different writings of pious men; and perhaps no book engaged more of their attention than "The Rise and Progress of Religion in the Soul," by the late Dr. Doddridge. The result of these conversations was the convincing of Mrs. Dawson, that the religious sentiments of Mr. Hey were true and well founded; she became, finally, not only a convert to his opinions, but an imitator of his piety; and continued his steady and affectionate friend to the end of her life.

Mr. Hey was accustomed to rise early, and thus secured an undisturbed portion of time for his devotions, for reading the Holy Scriptures and such books of piety as tended to confirm and increase his religious dispositions. He derived much satisfaction and benefit from the writings of the pious Mr. Nelson; and he often mentioned the "Serious Call to a Devout and Holy Life," by Mr. Law, as having been very useful to him. "At some times," said he, "my mind was much disturbed by not being able to understand many difficult passages in the Scriptures; Pascal's Thoughts, however, set me perfectly at rest on that point; and I know not that I have entertained a doubt on the subject ever since." It was very natural that doubts and perplexities should occur to a young, acute, and inquiring mind at its entrance on the serious study of the Scriptures, sometimes arising from the nature of the subjects on which they treat, at other times from the style and manner in which information is communicated. The insufficiency of objections founded upon the obscurities or difficulties which are met with in the inspired oracles, has been ably set forth by that eminent philosopher and exemplary Christian, the Honourable Robert Boyle. The same subject has been treated with much force and eloquence in the sublime thoughts of Pascal, and with still greater copiousness and perspicuity by Bishop Butler, in his masterly work on the analogy of natural and revealed religion. This able production, to which no regular answer has ever been published, displays a profound and often an original vein of thinking, a strength, coherence, and distinctness of argumentation, rarely equalled, and never surpassed by any theological writer ancient or modern.

As an apprentice, he conducted himself with great industry and fidelity; submitting to many services which ought not to be imposed on those who occupy a situation like his, and which, indeed, are not now required by any respectable professional man. He was prepared to find less repugnance to these employments, from the prudent method adopted by his mother who was accustomed to make her children, usually, wait upon themselves. During the first years of his apprenticeship, William Hey was assiduous in gaining a knowledge of the sensible qualities of the drugs in Mr. Dawson's shop, their medicinal virtues, and even the taste of the several articles he was employed to compound; but his curiosity once led him beyond the boundaries of prudence; being desirous of experiencing the "delightful delusions" of opium, as described by Jones, he took so largely of Matthews's pill, as to endanger his life. Mr. Dawson and his friends were seriously alarmed; and it was only after the lapse of several hours, with all the aid his kind master could render him, that the noxious agency of this deleterious compound could be subdued. William Hey, during his apprenticeship, obtained the approbation, and secured the permanent esteem, of those with whom he resided; his moral conduct was irreproachable, and his attention to the duties of religion regular and exemplary. With a mind well regulated, and under the direction of principles firmly established by careful study and due reflection, he went to London in the autumn of 1757 to complete his professional education under the able teachers, who, at that period, adorned their profession in the metropolis. Mr. Hey was attached to his studies; he was actuated by an ardent thirst after knowledge, and a steady determination of becoming the master of every subject to which he applied. It was a matter of duty with him to acquire a thorough knowledge of the profession he was to exercise, as far as that might be attainable, and he writes thus to his parents, after his arrival in London:—"I would spare no pains to qualify myself for that state of life to which the providence of God has called me, and then trust Him with the success of my endeavours." He considered anatomy as the foundation of all medical and chirurgical science, and determined, therefore, to acquire a competent knowledge of the structure of the human body. The first winter was devoted to anatomical lectures and dissections;

his application to this study was unintermitted; and having used the aid of books to direct him in this pursuit, as long as he judged it necessary, he continued to dissect without them, and composed a description of the nerves and blood-vessels from his own dissections, which, as far as he had proceeded in the work, was found to be sufficiently accurate. His assiduity, during this period, was exemplary, since he seldom employed less than twelve hours, daily, in the lecture and dissecting rooms, during the whole winter. By this unwearied application he acquired that share of anatomical knowledge which qualified him, eminently, for deriving superior advantages from his subsequent attendance on an hospital. Mr. Hey became a pupil of St. George's Hospital, under the late William Bromfield, Esq. in 1757, and began to officiate, as dresser, in June, 1758. The value of his acquirements in anatomy were more sensibly perceived by him every day; for he was aware that no one can be a competent judge of the nature of diseases, much less be qualified to perform operations, who is ignorant of the structure and relative situation of the parts affected. During the summer of 1758 he attended the Medical Lectures of Dr. Donald Monro, who was elected Physician of St. George's Hospital, after the death of Dr. Clephane. While Mr. Hey was pursuing his studies with indefatigable industry, he was never influenced by his avidity of information, nor the less rational allurements presented by the metropolis, to deviate from his sense of the duty he owed to the Supreme Being, nor to violate the moral obligations of Christianity. The gentle persuasions, or the scoffs and ridicule of his fellow-students, were equally resisted by his unbending mind. He was kind, friendly, and obliging, in every thing that had utility for its object; but, against the seductions of vice, he was firm and inflexible. The youthful companions of his studies would treat his seriousness with mockery, and sneer at the correctness of his conduct; yet they were constrained to allow the soundness of his understanding, and his superior attainments in professional knowledge. They frequently applied to him in matters of difficulty, and ever found him as cheerfully ready, as he was able, to assist them in their inquiries and to further and encourage them in their several pursuits. If he exhibited an unusual example of steady industry, he was not less a pattern of sobriety of deportment, strict regularity of morals, and zeal in the cultivation of every good and virtuous habit. As Mr. Hey was actuated by a strong sense of the duty he owed to God and to his fellow-creatures, to employ his time faithfully, he had likewise a fear lest he might give occasion to reproach on his religious profession, if he could be justly charged with idleness, or ignorance. Hence, he determined that none of his fellow-students should surpass him in those departments of knowledge, which it was his more immediate concern, at this time, to cultivate. His sentiments on this subject, nearly forty years afterwards, are well illustrated by the following letter to his son John, who was soon to commence his studies at Cambridge.

"June 20, 1795.

"Dear John,

"I have no objection to the plan you have proposed for the employment of your time, till you go to Magdalen College. You think, that, as your abilities are not great, much study at Cambridge may do you harm, and can bring you no great credit. I know not how far your abilities might enable you to proceed; but diligence in your academical studies is undoubtedly a duty. No desire of academical honours should lead a young man to injure his health by study; and no fear of want of success should deter him from a proper attention to the duties of his station.

"There is such pride in some students, that they will take no pains because they find they are incapable of attaining a high rank in the university. Be content with a low rank, if Divine Providence has made you incapable of a high one. But remember that one talent is to be improved, as well as ten. When I was a student, I always endeavoured to be at the head of my class. This diligence ensured me the regard of my teachers, and preserved me from many rude attacks from my equals. This I experienced very much when engaged in my medical studies at London, where I could not meet with one serious young man in my own profession. But, as I took such pains that my fellow-students were obliged to consult me in their difficulties, I preserved a considerable check upon their conduct. A serious young man who followed me, did not escape so well. His fellow-students at St. George's Hospital tossed him in a blanket. In your pursuit of knowledge, let it be your principal concern to gain clear ideas of what you learn. The design of mathematical and philosophical studies is to enable a man to reason well. This does not arise from the mere power of solving a hard problem, but, from a habit of reasoning carefully, and arranging our ideas and arguments with scrupulous care

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Our new habitation is not freed from plasterers and joiners, though your mother hopes to remove in August. How soon will our abode be confined to a few feet of earth! But, if our inward man be renewed day by day, as the outward man perishes, all will be well. Give my love to your brother and sister, and a kiss to my dear grand-children.

"I am, your affectionate father,

"WILLIAM HEY."

Early in the year 1759 Mr. Hey attended the Lectures of Dr. Mackenzie, in Midwifery. His assiduity in the studies of his profession in general, and of this important branch in particular, suffered no abatement; and he omitted no favourable opportunity of verifying, by practice, the instructions which he received from his teacher. Being aware of the disadvantage of engaging himself with a multiplicity of objects at the same period, it was his method to direct his *principal* attention to one subject at a time, without, however, absolutely neglecting others when his leisure would permit. He felt the importance of being thoroughly acquainted with the principles and practice of those professional gentlemen, under whose directions his studies were pursued; and, to accomplish this purpose the more certainly, he was accustomed to take a list of such doubts and queries as had occurred to him since the preceding lecture, and propose them to the teacher, either before, or after the lecture, as he found more convenient. On this subject, Mr. Hey, his son, observes, "I have heard him mention this, particularly in respect to the lectures in midwifery, and say, that he believed Dr. Mackenzie had scarcely an opinion with which he (Mr. Hey) had not, in this way, become acquainted." In a letter to his son, Richard Hey, who died many years ago, he offers the following advice on this subject: "When you attend Dr. Lowder and are come to that part of his lectures in which the pupils execute deliveries on the machine, I would advise you to sit by the machine all the time of lecture. I found more advantage from seeing the various ways in which others got wrong, than from being corrected, merely, for my own blunders. I used likewise to get leave to come a little before lecture began, to propose my doubts and queries, collected from reading and thinking on the subject, or arising from what had passed at *(the former)* lecture. Dr. Mackenzie was exceedingly kind to me in permitting this freedom."

Towards the end of the year 1758, a gentleman, resident in London, who had observed the great prudence and correctness of Mr. Hey's general conduct, and was acquainted with the integrity of his character, expressed his desire of uniting him in marriage with his own daughter. The proposal does not appear to have been disagreeable to Mr. Hey; but, with great propriety, he declined making any advances towards accomplishing his object, until he had consulted the wishes, and received the opinion, of his parents. His father's reply abounds with very judicious remarks on this subject. He offered many prudential reasons, to his son, against entering into such an engagement under his particular circumstances, although he showed no disinclination against his marrying at a more suitable period. As Mr. Hey submitted the direction of his mind in this important matter, implicitly to the judgment of his parents, so he exhibited his filial piety by an unreserved acquiescence in their determination. If young persons, in general, would condescend to ask the advice and listen to the suggestions of their parents, or judicious friends, in concerns of this consequence, before they have proceeded too far to recede with comfort and honour, they would be often preserved from connexions which become, subsequently, an occasion of bitter and fruitless regret. The most frequent sources of unhappiness in contracting such engagements are early inconsiderateness, vain self-sufficiency, or a spirit of proud independence. It never can reflect any dishonour on the understanding, or heart, of a young man, to embrace every fair occasion of thus giving honour to his parents.

Mr. Hey prescribed to himself, while yet a young student, certain rules for the regular dividing of his several employments, and improvement of his time. He rose early in the morning, and continued this practice, when in health, to the end of his life. He so arranged his occupations, that a particular portion of the day was appropriated to each; and, as far as the nature of the various objects of his studies would admit, he adhered to the rules he had imposed on himself with the most scrupulous exactness. By this orderly succession of business, at home and abroad, the hours of every day were consecrated to an industrious pursuit of useful and important knowledge. These laudable habits, acquired early and strengthened by regular exercise, preserved him through the succeeding periods of his life, not only from the criminal misemployment of time, but gave him a facility of filling up what may be termed the *parentheses* of time, with satisfaction to himself and utility to others. The sabbath-day was strictly and entirely devoted to the service of Almighty God. He never went to the dissecting room, nor would he accept any invitation to visit on that day, that he might not be tempted to deviate from his customary practice of attending divine worship three times; nor disturb his serious frame of mind by the interruption of unprofitable conversation, or the intrusion of worldly concerns. He has been often heard to say, "that his sabbaths were the happiest of his days, during his residence in London, and that the complete suspending of all his secular pursuits, prepared him to resume his studies with renewed ardour and alacrity." "On leaving London, he reflected with emotions of gratitude on the goodness of God, which had been manifested to him during his stay in that city. He had been preserved from falling by the various temptations to which his situation had necessarily exposed him. His health had suffered no interruption by his constant and intense application to study; nor had his religious principles been impaired by the conversation or example of his fellow-students; and although he had been frequently obliged to pass through streets inhabited by the most depraved characters in the metropolis, at all hours of the night, yet he never experienced any molestation. Hence he was induced to express himself, in the words of the royal Psalmist, 'He hath shewed me marvellous great kindness in a strong city.'"

Mr. Hey having completed his education in London, in the spring of 1759, his father, who was desirous that all his sons should be qualified to fulfil the highest duties of their respective professions, made to his son William the offer of prosecuting his studies in Paris. But he, having made such inquiries as he was able to do, respecting the probable advantages of such a measure, and considering the many disadvantages to a man of his character, that would be necessarily connected with a residence in the French capital, declined his father's proposal, and returned to Leeds in the month of April, 1759, to commence the exercise of his profession.

Mr. Hey continued a member of Mr. Wesley's society after his return to Leeds, and frequented their chapel at the hours which did not interfere with his attendance in his parish church; yet he by no means adopted all the opinions taught by the Methodists.

The gentleman formerly alluded to observes, that, "He entirely differed from the Methodists respecting the doctrine of perfection, and by no means accorded with their sentiments relative to the witness of the Spirit, and the necessity of instantaneous conversion. In the great essential truths of religion, as taught by the Church of England, he was in unison with them, and did not therefore judge it expedient to leave their Society on account of smaller differences."

It is unnecessary, at this time, to enter upon a discussion of the peculiar tenets sustained by Mr. Wesley and his associates at that period; or, to inquire into the changes, or modifications, which the experience of more than half a century may have introduced into their confession of faith, and rules of discipline.

Having seen Mr. Hey's safe return to Leeds, we conclude at that point our extracts from this very instructive Memoir of his Life and Writings. But as three months will elapse before we resume this subject, we consider it to be our duty, now to offer a few remarks on the concluding sentences of our extracts, and briefly to anticipate a small part of the succeeding narrative by an allusion to a sentiment appended to it. Before we enter on this delicate subject, we deem it proper to state, that we belong to neither of the religious denominations whom we shall have occasion to mention, and that we attach no blame whatever to Mr. Hey's most respectable and well-qualified biographer. Indeed, we have evinced no other feeling towards Mr. Pearson than one of kindness, and have felt for him no other than occasionally one of regret when we perceive the sanctity of editorial responsibility so greatly violated as to compel a biographer to insert his own palliative expressions, and liberal explanations, after different articles furnished by his correspondents, some of whom are represented to be connected with Mr. Hey's family, and who thus afford another painful proof—that the real foes of a man's reputation may unwittingly be "they of his own household."

One of these correspondents has observed that Mr. Hey "entirely differed from the Methodists respecting *the doctrine of perfection*, and by no means accorded with their sentiments relative to *the witness of the Spirit*, and *the necessity of instantaneous conversion.*" We have had occasion to search the historical records of this most extraordinary people and to examine their doctrines, long before our connection with this miscellany; we have therefore no hesitation in declaring, that the man who says, The Wesleyan Methodists maintain "*the necessity* of instantaneous conversion," is entirely ignorant of their doctrines, and maligns their characters.—The sense in which they hold *the witness of the Spirit*, is that of the most approved of our British Divines, especially those of the old school in the Church of England and among the Puritans. A learned friend of ours made a collection of extracts, in confirmation of this doctrine, from above a hundred eminent theologians; and we think he would confer a special service on the Church Universal, by publishing that collection. It might have the effect of inducing some of those who on this essential point have declined from the tenets and practice of their ancestors, to retrace their steps and to "do their first works."—In elucidation of *Christian Perfection* we have read Mr. Wesley's sermon and tract under that title, and could not discover in it any thing contrary to the analogy of faith, or the perfection so frequently mentioned in scripture.—Whether these three doctrines are a part of "the great essential truths of religion, as taught by the Church of England," to which allusion is made by this correspondent, we leave him and the Methodists themselves to determine. Our opinion however is, that, on appealing to the formularies of the Church, the advantage would be decidedly in favour of the views entertained and defended by the latter.

On these points Mr. Pearson, in his usual mild and agreeable manner, observes, "It is unnecessary .... to enquire into the changes, or modifications, which the experience of more than half a century may have introduced into their confession of faith, and rules of discipline." Those rules of their discipline, which are adjusted to local circumstances, (such as cautions against *smuggling* to the inhabitants of the sea-coast, and preservatives against *sedition* in infected districts,) are often modified. But those permanent rules which may be termed "the moral law" of their body, have remained without change since they were first promulgated by their excellent Founder. We know of no "confession of faith" which they hold, except that of the Church of England; and in this no alteration has occured within the period of their existence as a religious denomination. No minister, when his four years of probation have expired, is admitted into full connexion with them, till he has been closely examined respecting his belief in the doctrines of the Church of England as explained by Mr. Wesley in his sermons and notes on the New Testament. The only "confession of faith" required from private members wishful of participating in their religious advantages, is an expressed "desire to flee from the wrath to come:" This also, with regard to all their catechumens, has experienced no change or modification.

But whatever alterations may be imputed to the Methodists, we have enjoyed personal means of ascertaining that considerable changes were introduced into the articles of Mr. Hey's belief soon after he left the Methodists. We have in our possession a portion of his correspondence with one of his earliest Methodist friends, in which he evinces a most heavenly disposition, and an earnest desire to enjoy all those blessings which he viewed as the privileges of his dispensation. It is necessary to state, that this was previous to the birth of any of his surviving children, and consequently before any of his daughters could be married to clergymen, or his sons enter into holy orders.

Another religious denomination soon afterwards receives its share of sly rebuke. The intimacy between the celebrated Dr. Priestley and Mr. Hey, will be hereafter related. While they were aiding each other in the acquisition of chemical knowledge, they published tracts in favour of their different religious creeds against each other; yet this circumstance occasioned no kind of shyness between them. "The high opinion in which Dr. Priestley held the talents and acquirements of Mr. Hey, both as a professional man and a philosopher, induced him to propose this gentleman as a proper person to be admitted into the Royal Society;" and through his interest he was accordingly elected a Fellow in the year 1775.—On this subject Mr. Pearson speaks like a gentleman and a Christian. He says, "The friendship long cherished by those two philosophic men, will be thought highly creditable to the candour and liberality of their minds, &c."

It appears, however, that "this candour and liberality" are not thought by some persons to be "highly creditable" or perhaps altogether salutary: For "a clergyman nearly connected with Mr. Hey's family" proceeds to make the following very unhandsome insinuation respecting this friendly intercourse with Doctor Priestley: "How far this intimacy may be justified, and whether Mr. Hey in the later periods of his life, would have formed it,—is a question on which his friends may possibly differ." Without quoting the large and very liberal excuse for this opinion tendered by Mr. Pearson, who thinks that "*modesty* and *charity*, twin virtues, may be admitted to a hearing" on this agitated question,—we may be permitted to remind even a clergyman that the same scripture which commands us to do good to *those who are of the household of faith*, commands us also to do it TO ALL MEN. According to the principle on which this clergyman wishes men to act, the common courtesies of life and intercourse of society must be suspended, till we have ascertained whether the person who courts our intimacy be a Socinian, a Methodist, a Quaker, or a member of some other obnoxious community. Away with all such unchristian surmises! Let us not cherish Punic and interminable enmities against those who differ from us in the matter of religion: But let us endeavour to convince the gain-sayers, by giving them tokens of our kindness and our sincere wish to serve them, rather than proofs of our proud dispositions and unhumbled hearts. Thus shall we more nearly imitate HIM who loved his enemies even to the death, and who has invited us to evince the same lovely spirit.

The Rev. ROBERT HALL, of Leicester, has been lately taxed at the bar of the public as the eulogist of Dr. Priestley. For the benefit of the "clergyman connected with Mr. Hey's family," we transcribe the following part of that great man's reply to the accusation, and with this extract we conclude our present observations:

"Dr. Priestley, it is acknowledged, was a Socinian; but it was not under that character that he was eulogized. It was as the friend of liberty, the victim of intolerance, and the author of some of the most brilliant philosophical discoveries of modern times, for which he was celebrated throughout Europe, and his name enrolled as a member of the most illustrious institutions; so that my eulogy was but a mere feeble echo of the applause which resounded from every civilized portion of the globe. And are we suddenly fallen back into the darkness and ignorance of the middle ages, during which the spell of a stupid and unfeeling uniformity bound the nations in iron slumbers, that it has become a crime to praise a man for talents which the whole world admire, and for virtues which his enemies confessed, merely because his religious creed was erroneous? If any thing could sink Orthodoxy into contempt, it would be its association with such gothic barbarity of sentiment, such reptile meanness."

SARDANAPALUS, *a Tragedy; the* TWO FOSCARI, *a Tragedy; and* CAIN, *a Mystery.* By LORD BYRON.—London, 8vo. pp. 439.

THE tragedy of SARDANAPALUS, the least exceptionable and the most highly finished production in the volume, claimed much of our attention in the last number; the TWO FOSCARI, therefore, and CAIN, must, from the inferior interest which they possess, be treated with brevity. In a subsequent number, we will insert, under our poetic department, a few passages which we had marked for quotation, but which we are now unable to crowd into our pages.

The story of *the Two Foscari*, as narrated by Lord Byron, is soon told:—The younger Foscari, whose father was Doge of Venice, being accused of having accepted presents from foreign princes, which was a positive infraction of the laws of the Republic, received sentence of perpetual banishment from the COUNCIL OF TEN, an arbitrary court, possessing similar powers to those of the Star Chamber among our ancestors. When he had been five years in a state of exile, one of the Council of Ten was assassinated; and the suspicions of that tyrannical body fell upon the banished Foscari, one of whose domestics had been seen in Venice at the time when the murder was perpetrated. The master was brought to Venice, and subjected to the torture, without producing any confession of guilt. His firmness having been attributed to obstinacy and not to innocence, he was again ordered off to the spot of his former banishment, from whence he incessantly addressed letters to his father and other friends, to intercede in his favour and to procure a revocation of his hard sentence. Finding this method ineffectual, he invented another scheme, and addressed a letter to the new Duke of Milan, in which he intreated him,—by the favours which his father the Doge had conferred on the Ducal family,—to interpose his good offices in favour of an innocent son of the Doge of Venice. He was again recalled to Venice and underwent all the refined cruelties of the torture, without making any confession, except that he had written the letter to the Duke, purposely that it might fall into the hands of his enemies and that his eyes might again behold Venice, "the Rome of the Ocean," although the only method of obtaining such a sight would be by visiting his native country as a criminal. Not being able to subdue his constancy, the Council of Ten, over whose deliberations his father had to preside as Doge of the Republic, condemned him again to be banished from the Venetian territories. But while he is proceeding to the place of embarkation, accompanied by his wife and father, he dies broken-hearted; and his father, soon afterwards, on being required to resign his high office, falls a victim to the malice of his enemies, who have been the secret authors of all the troubles of the family, in order to revenge themselves of some supposed injuries.

But the most paradoxical circumstance about the story is, that *the love of country* is made by the noble author to be the ruling principle in the breast of the younger Foscari, and to swallow up every other feeling. In a conversation with his wife, he says,

You call this weakness! It is strength,
I say,—the parent of all honest feeling.
He who loves not his country, can love nothing.

And when she proposes to become the companion of his exile, and to leave her children behind, he asks,

And canst thou leave them?

MARINA.

Yes, With many a pang.
But—I *can* leave them, children as they are,
To teach you to be less a child. From this
Learn you to sway your feelings, when exacted
By duties paramount; and 'tis our first
On earth to bear.

JACOPO FOSCARI.

Have I not borne?

MARINA.

Too much
From tyrannous injustice, and enough
To teach you not to shrink now from a lot,
Which, as compared with what you have undergone
Of late, is mercy.

JACOPO FOSCARI.

Ah! you never yet
Were far away from Venice, never saw
Her beautiful towers in the receding distance,
While every furrow of the vessel's track
Seem'd ploughing deep into your heart; you never
Saw day go down upon your native spires
So calmly with its gold and crimson glory,
And after dreaming a disturbed vision
Of them and theirs, awoke and found them not.

MARINA.

I will divide this with you. Let us think
Of our departure from this much-loved city
(Since you must *love* it, as it seems), and this
Chamber of state, her gratitude allots you.
Our children will be cared for by the Doge,
And by my uncles: we must sail ere night.

In this tragedy much interest is involved; and it exhibits many noble traits of suffering virtue, without the usual portion of deteriorating sentiments which our author has been accustomed to infuse into his late poetic effusions.

We cannot say as much as this in behalf of CAIN, which Lord Byron has properly designated "a Mystery," and which it is evident, from the laboured explanations in the preface, needed more apologies to smooth its entrance into the world than his lordship usually gives. On account of the strong resemblance which may be traced between the *Dramatis personæ* of his Cain, and those of Gesner and Milton in the *Death of Abel* and *Paradise Lost*, he wishes the world to know, that he has not, for several years past, read either of those pleasing productions: Perhaps his own style of writing would have been improved, had he given them a perusal; for both of them greatly excel his phlegmatic performance, both in pathos and genius. All other parts of the preface seem to be written with a studied design to insult religion, and to ridicule the motives by which christian men profess to be governed, in the formation both of their conduct and their belief. We consider this as the very apex of his Lordship's high offences. A specimen of his disgusting effrontery may be seen in the following sentence:—"With regard to the language of Lucifer, it was difficult for me to make him talk like a clergyman upon the same subjects; but I have done what I could to restrain him within the bounds of spiritual politeness." These expressions will be viewed by Lord Byron, and his heartless associates, as wit of a sublime order. But his lordship does not seem aware, that all the *finesse* of his Satan, may be set aside or rendered harmless by the simple consideration of this scriptural verity, which will occur to the humblest believer in the christian revelation, that the Devil is the father of lies, and the truth is not in him. A recollection of this circumstance will neutralize all those ominous properties with which this malignant being is here most artfully invested.

"In every work regard the author's end," is an ancient canon of criticism, by which every literary man that possesses a character for impartiality will wish to be governed. But unhappily in this case, as in some others, we are forced to resort to a *petitio principii*, and to conjecture how Lord Byron would on this occasion put the preliminary question (CUI BONO?) to his conscience, and the kind of answer which it would return. We can imagine it barely possible that a good man might be induced to rake together the blasphemies and "hard sayings" of all the infidels of ancient and modern times, to relieve from an irksome occupation those who might be afterwards called to the duty of defending the truth and of exposing existing errors by associating or comparing them with the kindred sentiments of former ages: But such a man would not clothe them in a meretricious and alluring dress, and thus endeavour to hide the deformities of vice and to injure the interests of virtue. Lord Byron, therefore, could have felt no regard for the welfare of his species, when he engaged in this preposterous labour; and he has obtained such a *reward* as he never anticipated. He had foolishly imagined, because the unprincipled part of the British public derived entertainment from the most obscene of his descriptions, and because some well-meaning individuals had winked at his rather frequent demoralizing vagaries, that his reputation might with impunity venture itself on a work of the most refined Atheism that could be devised. The adventure has been made, and has failed of success; and "CAIN, a Mystery," is now placarded, *in terrorem* throughout the Metropolis, only at the petty shops of the lowest retailers of sedition and blasphemy. The deluded followers of Paine, Carlile, and Cobbett have claimed it for their own, and the justice of their claim has been admitted. The highest court of equity in these realms has, in the person of the Lord High Chancellor, declared the work to be inimical to the Christian Religion and the law of the land, and, as a necessary consequence, that no injunction can be granted in that Court against those who pirate it, and no legal redress afforded. The noble author, whose powers were capable of better and more useful efforts than this, after all his affectation of stoical apathy and *nonchalance*, has felt his pride wounded, and his learned laurels tarnished, by this double decision against him on the part of the Lord Chancellor and all the virtuous portion of the community. He has sent a letter of condolence to his publisher, and offers to come to England to take all the blame of the publication on his own shoulders, which, in the opinion of many competent judges, are already overcharged with burdens of a similar description, in consequence of his previous delinquences and disreputable poetic licenses. Had his Lordship written nothing more faulty than those revolting speeches, which the actors in his drama utter, respecting the incest which, with most prurient imagination, he has imputed to the immediate descendants of Adam and Eve, he would have incurred deserved execration from every virtuous parent who has any regard to the moral purity and the eternal welfare of his offspring and connections.

The great fault of Lord Byron in meddling with subjects of Divinity, is, that he makes his Devil too subtle a casuist, and his Cain one of the weakest polemics "that ever bore a schoolman's shield" or hurl'd a syllogistic spear—a son destitute of all that interesting and varied information which, his Lordship might naturally suppose, would be communicated by the first of men to all his sons. His Lordship's ignorance of Divinity is very apparent, even in passages in which he aims at the sublime and beautiful in expression and effect. In Abel's prayer, delivered prior to the offering up of his sacrifice, no allusion is made to that great Expiatory Atonement afterwards actually to be offered for human guilt and transgression, and of which atonement that primitive mode of immolating "the firstlings of the flock" was typical. In this instance, as in several others, there was no Lucifer in the scenery to tempt the poet astray; but, it is most evident, he has spontaneously chosen that course for himself.—Several of the curses, which the unhappy mother of our race bestows upon the first murderer, remind us strongly of the refined curses which his Lordship so artfully bestowed, in *otherwise* elegant verses, on a supposed female personage that was accused of having sown discord between him and his virtuous lady. The mention of Lady Byron reminds us of some qualifying circumstances in his Lordship's favour, which are developed in these three dramas, and our observations on which we shall present to our readers, as a separate article, in our next quarterly publication.

FEMALE MATHEMATICIANS.

TO THE EDITOR.

Sir, The object of Didascalus in writing, and your's in inserting, the paper in your third volume on female mathematicians, I hope and can readily believe was benevolent; but whether it has been accompanied with greater good or evil, is a question which remains yet to be solved. A very natural consequence of its appearing in your book, was that of arresting the attention of the fair,—those weathercocks of the world so implicitly obedient to the guidance of novelty which ever way it blows. If you have already perceived that I am presenting myself in the character of a judge, you have saved me the expression, and yourself the tædium, of a longer introduction. By way of prepossessing you in favour of my impartiality, before I enter at large on the merits of the case, I shall premise one benefit arising from the female Mathematical mania which has infected some neighbourhoods. My profession being that of a bookseller, of course I keep a stock of books. Of many of the books in my catalogue I have but single copies; it being a maxim with me to keep a number of copies of such books only as are required for general use. Among the latter I include all school-books, whether Classical, Mathematical, Arithmetical, Grammatical or anyother*al* that may please scholars. Now, Sir, the good of which I am able from personal experience to speak, is this: Since the publication of the letter of Didascalus, I have not only had repeated orders for different treatises by Bonnycastle, Hutton, Simpson and Gregory, but I have also sold no inconsiderable additional number of your valuable miscellany in this town and neighbourhood. And if all the booksellers within the various counties in which the Leeds Correspondent circulates, have had the like experience, certainly Didascalus has many debtors.

Whoever heard of a bookseller that was long a bachelor?—At least, I am not one. I worshipped before the altar of Hymen with a downy chin; and, wreckless of consequences, I rashly made the promise of "better and worse,"—the latter of which cups I am now drinking in NON *modicis cantharis.* The seventh day of July 1819 was the fifth anniversary of my wedding-day, and, excepting now and then a passing cloud between my wife and me, we had lived a peaceable and pleasant life. By the goodness of providence I was blessed in my going out and coming in; and, ignorant alike of

———plagues which vex the poor,
And cares which haunt the rich man's door,
Embittering all his state,

I was enabled to fill up my sphere with respectability and credit. While I carried on the business of the shop, my wife directed the affairs of the family; and each of us being thus engaged in the occupations that were suitable to each, we "held the noiseless tenor of our way," and our days passed cheerfully along almost unawares. Happy in the affections of an amiable and industrious wife and the innocent and engaging prattle of my two little children, I always adverted with pleasure to the day of my marriage, and made a point of devoting the return of that auspicious period to purposes of agreeable relaxation and entertainment. In conformity with this arrangement, I had assembled a party of select friends in 1819, and we were enjoying ourselves in desultory conversation over wine and fruit, when one of my youths announced the arrival of the Leeds Correspondents, among other publications, in my London parcel. As several of the gentlemen present were subscribers to it, I laid a quantity of them upon the table, thinking it might please them to have so early a sight of its instructive pages. In less than a minute they were all in hand, and each eye was intently gazing on the CONTENTS. "*Female Mathematicians!* I declare," exclaimed several voices almost simultaneously, and it was carried "without a division," that my wife (who, I must say, possesses an excellent gift of elocution,) should read that article aloud for the gratification of the ladies. In the mean while I now and then stole a circuitous glance around the room, marking the effect which was produced on the features of the female portion of my visitors. The men were grave and thunderstruck—as though fearful of some sudden explosion: but their countenances brightened when the writer dropped on paper that *lapsus pennæ*—his being "elected supervisor," in a company of female mathematicians. The ladies were delighted, and seemed anxiously awaiting the close of the epistle, that they might have an opportunity of pronouncing their individual encomia on the amusing scheme which was there developed. The reading of it was followed by a lively debate upon the subject; in which the males evinced much strength and acuteness of argument, and the females considerable readiness of wit. Many were the objections raised on the one side, but they were as quickly rebutted on the other; and we were at length compelled to agree, that with some regulations and restrictions, the plan of Didascalus might be productive of considerable benefit.

"Who is ignorant of the influence of fashion among ladies?"—Very few; and I verily believe that the circumstance of Philosophical amusements and Mathematical recreations having become fashionable, was, in the estimation of my female friends, the strongest of all arguments in favour of their adoption, and the most powerful stimulus to the study of those masculine branches of learning. Be that as it may, in less than a year many of these became tolerably expert mathematicians and newly-fledged philosophers, and (O unhappy me!) my wife among the rest. It is not much out of character, or injurious to any other person, for a Newton to forget his dinner in the labyrinthine sinuosities of philosophical research: If any one suffers by it, it is only himself. But nothing can be more prodigiously anomalous and unnatural, than for the wife of a tradesman to be puzzling her brains with the solution of a difficult problem when the dinner should be smoking hot on the parlour table, and her family partaking of it. Omitting all mention of that well-known maxim, "that a man of business cannot possibly endure irregular dinner-hours," I may state that when my spouse is detained in her room by these fascinating novelties, she is not the only sufferer, but she is filling her house with the clamours of her hungry children and endangering their health by too long fasting. Some parts of the Mathematics are allowed to be the most difficult and abstruse of all the objects of human science, and offering the widest range to man's discursive intellect: To the most obtuse understanding, therefore, it must be evident, that the study of Mathematics is entirely incompatible with the occupations of one on whom the daily cares and minute concerns of a family have devolved. It is granted, that the initiatory rules do not require so complete an abstraction of thought as to prevent a person from combining the study of them with the practice of other ordinary duties: But then, this science is so attractive in its very nature, that those who have once devoted themselves to it, are not content with a knowledge of its first principles, but must inquisitively dive into its unfathomable profundities.

Before my wife turned mathematician, she was a little addicted to card-playing. Being an enemy to all kinds of gaming or gaming instruments, I did not at first regret the alteration in her pursuits. But when, with a smile of approbation, I saw her make this change, I had not counted the cost. To the "Doctrine of Chances" I was as inimical as Didascalus pretends to be, and could have reprobated it in terms of equal plausibility. When he tells you, that cards have a tendency to excite the most malignant passions of our nature, he states no new truth; it has often been urged before,—and though sometimes with too little discrimination, yet not always without truth. But whether is it worse for some few evil passions to be partially and only momentarily excited, or for all the passions (good, bad, and indifferent,) to be entranced, and that not merely at intervals, but continually throughout the day, and day after day? It is only when cards are in the hand that they can thus stir up evil passions: but the mind may be employed in Mathematical speculations when no scientific treatise is near. When cards were the amusement of those evening parties which we sometimes had, no previous preparation was required; but now that Mathematics have become their substitute, it is necessary, that those who derive delight from them should be constantly preparing for competition at the next meeting. For the spirit of emulation will not allow them, through negligence, to be found wanting in a trial of skill. In this emulous spirit my wife is not deficient, whatever she may be in point of skill. Compelled by this impulse, and by the fascinating nature of her study, her mind is literally dead to every thing else; every other pleasure but that which she derives from Mathematics is apparently a forbidden one; all other passions are wound up in that for mathematical knowledge; and to perform the most trifling duty as a wife, a mother, or a mistress, seems to be an irksome task. According to the general opinion of the most approved writers on the subject, this abstruse study, in any one of its branches, requires an entire abstraction of thought. This will infallibly engender an habitual absence of mind; the only definition of which is, that it is a state in which all the faculties and passions of the soul are either inactive and insensible, or absorbed by one object.

But the main intent of my writing is by no means to prove the superiority of cards over mathematics; and therefore if in my incidental remarks I have failed to establish this point, I shall not be sorry. My real purpose was, to shew that the study of Mathematics, as they are and ought to be studied, is incompatible with the matronly duties of a good housewife. This also I have attempted to shew in the case of my wife; and I think that fact is satisfactorily proved. And if this anonymous exposure have the effect of recalling her to those pleasing paths of duty in which she formerly walked in a manner so well becoming her station, I shall hail you as one who has contributed greatly to the re-establishment of my domestic happiness.

It may answer for old maids thus to while away the precious time which is not required by their monkeys and lap-dogs, but these severe studies never can compete with the management of a family. You are perhaps yourself aware, (if you be a husband,) that if you were to interfere in culinary affairs, even the housemaid would speedily talk about pinning a dish-cloth to the tail of your coat. Why then should the ladies be suffered to encroach on our studies, or to intermeddle with masculine concerns?

I am, Sir,

Liverpool. BIPLIOPOLA.

UTILITY OF MATHEMATICAL LEARNING,

At the Anniversary Meeting of the Royal Society, on St. Andrew's Day, (Nov. 30.) the President, Sir Humphry Davy, announced the allotment of two of Sir Godfrey Copley's prize medals to J. F. W. Herschel, Esq. and Captain Edward Sabine, in a very appropriate and impressive discourse, of which the following is an outline.

The progress of discovery, said Sir Humphry, even when belonging to past times or distant countries, is always an agreeable subject of contemplation to philosophical men, but the pleasure derived from it is much higher when it arises from the exertion of the talents of our own countrymen, when it has originated in our own body, and when there is the power not only of acknowledging and rejoicing at it, but likewise of distinguishing the persons to whom it is owing, by a permanent mark of respect; he, therefore, had much satisfaction in announcing the decision of the council of the Society, upon the present occasion. The President then took a review of the labours of Mr. Herschel, son of the famous astronomer, and more particularly of those which were considered as entitling him to the present mark of distinction. He said, there was no branch of science more calculated to awaken our admiration than that which Mr. Herschel had so successfully cultivated: the sublime or transcendential geometry not only demonstrated the powers and resources of human intellect, but also the wisdom and beauty of the laws which govern the universe. It is, perhaps, said the President, the highest triumph of human intelligence, that proceeding from the consideration of mere unities, or points, lines, and surfaces, it should by gradual generalizations, substitutions, and abstractions, be able to arrive not only at the knowledge of all possible conditions of number and quantity, but likewise of time and motion; and by employing its own pure intellectual creations, in many cases anticipate the results of observation and experiment, and determine the movements not only of the bodies which form permanent parts of our system, but likewise of those which seem only occasionally to visit it, and which belong as it were to the immensity of space.

Sir Humphry then paid an eloquent tribute of applause to the zeal and success with which Mr. Herschel had pursued these enquiries, and proceeded to enumerate his mathematical communications to the Royal Society, printed in their Transactions. He should not, he said, attempt an analysis of these papers, for they required profound study: they were especially distinguished by the simplicity of the processes, by perspicuity of arrangement, and by the absence of all metaphysical abstractions, and they proved in the author an intimate acquaintance with the works of the great masters of analysis; he had not, however, limited himself to formulæ, but had a higher claim upon the approbation of the Society in their application; for, though as a mere exercise, the higher mathematics strengthen the reasoning faculties and afford intellectual pleasure, yet it is in enabling us to solve the physical phænomena of the universe that they have their grandest end and use; in these respects, said Sir Humphry, they are really power, and they may be compared to that power which we witness in the vapour of water, which passing into the free atmosphere, exhibits only a striking spectacle, but which applied to the steam-engine, becomes the moving principle of the most useful and extensive machinery, and the source of the most important arts of life.

Sir Humphry then adverted more particularly to Mr. Herschel's investigations connected with the polarization of light, and to the importance in practical optics of his paper on the aberration of compound lenses and object glasses; and having stated to the Society the leading features of these communications, said, that he felt convinced they could not but approve of the decision of their council upon the grounds he had already mentioned, and should therefore not attempt further to expatiate upon the diligence and merits of their author.

In addressing Mr. Herschel personally, Sir Humphry alluded to several subjects of enquiry, which he recommended to Mr. Herschel's attention; he trusted that he would continue to devote himself to philosophical pursuits, and that he would receive the medal not merely as a mark of respect for acquirements already made, but as a pledge of future exertions in the cause of science, and of the Royal Society. "Believe me," he added, "you can communicate your labours to no public body by whom they will be better received, or through whose records they will be more honourably transmitted to the scientific world. And these pursuits, you will find not only glorious, but dignified, useful, and gratifying in every period of life; this, indeed, you must know best in the example of your illustrious father, who, full of years and of honours, must view your exertions with infinite pleasure, and who, in the hopes that his own unperishable name will be permanently connected in the annals of science with yours, must look forward to a double immortality."

The President then spoke of the researches of Captain Edward Sabine; he eulogized his industry and perseverance in conducting his inquiries into the Arctic Expedition, and his fortitude and patience in enduring the hardships and privations to which he was then exposed: his experiments, he said, were principally conducted on the ice of the polar sea, where the vessel was for several months frozen up; during a considerable portion of the the time, he was in darkness, or only guided by a very doubtful twilight, and the temperature of this inclement spot, probably as cold as any belonging to the northern hemisphere, was such, that the artificial horizon of mercury became frozen during an observation; yet Captain Sabine's inquiries seem to have been conducted with as much care and precision as if he had been possessed of the conveniences and luxuries of a Royal Observatory, and the advantages and repose of the happiest climate and situation.

CURIOUS THEORY OF THE ORIGIN OF VOLCANOES.

There is a mountain called Mount Brasier, situated between Senes and Larógne, in the Alps, which has been reported from time to time to emit noises and flame. This report has been verified by M. Dubois-Amé, who, when in the neighbourhood in 1818, examined the mountain, collected evidence of the flames having been seen, and himself heard detonation in the mountain. On examining the mountain, he found that in the strata of limestone that formed its sides, were beds of pyritous chalk, marly schists, radiated sulphuret of iron, bituminous substances, &c., and he concludes that the flames and noises are produced by the accidental firing of hydrogen liberated by the action of water on these substances. It is to be remarked, that the detonations are most frequent when the wind is in one direction, an effect probably due to the mixture that then takes place of air with the hydrogen within the crevices of the mountain. —*Ann. de Chim.*, xviii., p. 158.

DECEITFUL NATURE OF THE USUAL TESTS FOR ARSENIC.

Dr. Porter, of the University of South Carolina, in observing on the Tests for the detection of arsenic, remarks, that an appearance, similar to Scheele's green, is produced by carbonate of potash, added to a solution of copper containing coffee, but without arsenic, more striking than if a weak solution of arsenic be used. He also states that, in the production of Scheele's green by arsenic, sulphate of copper and carbonate of potash, chromate of potash might be substituted for the arsenic; and that the precipitate produced, could not be distinguished by the eye from Scheele's green. Also, that Mr. Hume's test of the nitrate of silver (as modified in its application by Dr. Marcet,) gave, with chromate of potash, a yellow precipitate, which, when placed side by side with one produced by arsenic, could not be distinguished by colour or appearance from it.—Silliman's *Journ.* iii. p. 355.

STEAM ENGINES.

M. Dupin, whilst speaking of the immense mechanical force set in action by the steam engines of England, gives the following illustration of its amount. The great pyramid of Egypt required for its erection, the labour of above 100,000 men for twenty years: but if it were required again to raise the stones from the quarries, and place them at their present height, the action of the steam engines of England, which are managed at most by 36,000 men, would be sufficient to produce the effect in eighteen hours. And M. Dupin says, that if it were required to know how long a time they would take to cut the stones and move them from the quarries to the pyramid, a very few days would be found sufficient.

The calculation of M. Dupin is as follows: the volume of the great pyramid, is 4,000,000 cubic metres, its weight is about 10,400,000 tons, or 10,400,000,000 kilogrammes. The centre of gravity of the pyramid is elevated 49 metres from the base, and taking 11 metres as the mean depth of the quarries, the total height of elevation is 60 metres, which multiplied by 10,400,000 tons gives 624,000,000 tons raised 1 metre. Then the total of the steam engines in England represents a power of 320,000 horses. These engines, moved for 24 hours, would raise 862,800,000 tons 1 metre high, and consequently, 647,100,000 tons in 18 hours, which surpasses the produce of labour spent in raising the materials of the great pyramid.

EQUALIZATION OF WEIGHTS AND MEASURES.

In the *Edinburgh Philosophical Journal* some most interesting observations have been made, by the Rev. G. S. Keith, D. D., on the final report of the Commissioners of Weights and Measures appointed by Parliament. Much disappointment, it will be recollected, was felt in the scientific world, when that honourable Commission tendered to the world the result of their deliberations and experiments. We quote with pleasure the following concluding remarks by Dr. Keith:—

"After all, it may be well worth considering, whether, as a multitude of provincial standards must be laid aside, it would not be advisable to take a correct and invariable standard from nature, the pendulum that vibrates seconds for example; to divide this decimally,—to establish either a cube or a cylinder of its dimensions, filled with distilled water of 40° of heat, or with common water at a moderate temperature, as a standard tun weight, and also for both dry and liquid measures of capacity,—to get weights and measures made correctly from this standard,—to send them to all the market towns, and to put them under the inspection of the Magistrates; but to *compel no man* to use them unless he choose to do so. By dividing the denominations of this standard, not into 2, 4, 8, 16, as at present with some weights; far less into 7, 14, 28, 112; but into 1, 2, 3 and 4 of the next inferior denomination, 24 pieces of metal could weigh out 1, 111, 110 different weights, or *three* corn measures, with boards of partition having 1 and 4 tenths of their measure on one side, and 2 and 3 tenths on the other, could measure out 1110 different quantities of corn, and a merchant's apprentice could perform an operation in reduction of decimal fractions, merely by weighing or measuring his goods. In a short time the new weights and measures, *which ought to be called Commercial ones*, would become familiar,—would, from their simplicity and accuracy be gradually introduced, and would in a few years become general, when they might be established. But till that time, no authority higher than the influence of fashion and example should be exerted, no compulsion, no licenses, no fines should be introduced. These things would defeat the object intended to be accomplished; for men will not be dragooned into any public measure, even though its adoption were advantageous; yet if left to themselves, they will embrace what will promote their interest.

"I would conclude these observations by relating a fact consistent with my knowledge.

"A clergyman, with whom I was intimately acquainted, had a servitude of a footpath which led diagonally through a valuable field, part of his glebe or parsonage lands, and along which the people as they passed to or from the church could look in, both at the front and gable windows of his house. Their weekly visits both annoyed him and injured the field through which they travelled; and as he could not get free of this servitude by compulsion, he had recourse to art. He made out a very good gravel walk, and frequented it daily for some time, as if it had been made for his private use and amusement. Winter came on, a good deal of rain fell, and the diagonal footpath became very dirty and unpleasant to the people going to church, or returning home. A few of them ventured to try, whether the Minister would allow them the use of his fine gravel walk; and when they were not interrupted, others soon followed their example. In a little time they all deserted the diagonal footpath, and went along the gravel walk, which, though a little longer was a much better road, and by which they could walk nearly as soon, and with much more comfort.

"It is in this way, I apprehend, that the Legislators of this free and great commercial country should proceed, in equalizing our weights and measures. They should make new and correct standards, decimally divided. They should send them to the market-towns, and put them under the protection of the Magistrates, along with accurate tables shewing their relation to the other national and provincial weights and measures. They should use them themselves, and promote resolutions for that use, but employ no compulsion for their introduction; while they punish severely all frauds in those who use the old or provincial standards. If established on sound principles, the people will soon generally adopt them; and at no distant period they will be introduced and established among all trading nations."

THE FORMATION OF WATER-SPOUTS.

In a learned and scientific paper, inserted in the last number of the *Edinburgh Philosophical Journal*, the Honourable Captain Napier, R.N., has given an account of an extraordinary sort of whirlwind, which he observed at a short distance from his Majesty's ship Erne, on the

6th of September, 1814. Describing this whirlwind, the Honourable Capt. says:—"It carried the water up along with it in a cylindrical form, in diameter to appearance like that of a water-butt, gradually rising in height, increasing in bulk, advancing in a southerly direction, and, when at the distance of a mile from the ship, it continued stationary for several minutes, boiling and foaming at the base, discharging an immense column of water, with a rushing or hissing noise, into the overhanging clouds; turning itself with a quick spiral motion, constantly bending and straightening, according as it was affected by the variable winds which now prevailed alternately from all points of the compass. It next returned to the northward in direct opposition to the then prevailing wind, and right upon the ship's starboard beam, whose course was altered to east, in hopes of letting it pass a-stern. Its approach, however, was so rapid, that we were obliged to resort to the usual expedient of a broadside, for the purpose of averting any danger that might be apprehended, when, after firing several shots, and one, in particular, having passed right through it at the distance of one-third from its base, it appeared for a minute as if cut horizontally in two parts, the divisions waving to and fro in different directions, as agitated by opposite winds, till they again joined for a time, and at last dissipated in an immense dark cloud or shower of rain.

"The near edge showered in large heavy drops on the ship's deck, until the cloud was quite exhausted.

"At the time of its being separated by the effect of the shot, or more probably by the agitation occasioned in the air by the discharge of several guns, its base was considerably within half a mile of the ship, covering a portion of the surface of the water, at least half a furlong, or even 300 feet in diameter, from one extreme circumference of ebullition to the other, and the neck of the cloud into which it discharged itself, appeared to have an altitude of 40 deg. of the quadrant, while the cloud itself extended over-head, and all round to a very considerable distance.

"Allowing, then, from the ship, a base of a little more than one-third of a nautical mile, say 2050 feet, and an angle of 40° to the top of the neck, we shall then have, for the perpendicular height of the spout, about 1720 feet, or very nearly one-third of a statute mile. A little before it burst, two other water-spouts, of an inferior size, were observed to the southward, but their continuance was of short duration."

In endeavouring to account for it, he adds:—"In proceeding to examine the subject, we shall suppose that the water rose from the sea *in vacuo*, or rather in a cylindrical space approximating to that of a vacuum, and that it was caused so to rise, *in part*, by the pressure of the atmosphere circumscribing the base of the said vacuum. Having allowed so much, we can go no farther without violating the well-known law, that "water cannot rise *in vacuo*" above 32 feet; admitting, therefore, that it was even assisted to that small height, we shall have availed ourselves of the theory, as far as truth or reason can justify.

"If we say that water is drawn upwards by the suction of a cloud, as proposed to be exemplified by Mr. Oliver with a quill over a glass of water, we shall then begin to establish the theory of "suction," perfectly irreconcileable, also, with the equally well-known fact of the gravity of the atmosphere. Besides, the force of Mr. Oliver's lungs, over a glass of water, can bear no analogy to that of a cloud overhanging the surface of the sea. It appears also strange to talk of an *empty* cloud, or a *half-exhausted* cloud, for clouds are not *aerial bags*, as some would have them to be, but vapours overhanging the earth at different heights from it, according to the proportion of humidity or density contained in themselves, and which, when, by reason of their greater weight, they fall within the sphere of the earth's attraction, begin to discharge themselves in rain, till, being reduced in size and density, if not totally consumed, they naturally rise above the sphere of attraction, and, regaining the higher parts of the atmosphere, again attract each other, and repeat such operations to the end of time.

"Setting aside, then, the theory of suction, and the idea that the water-spout could rise in a body to the clouds, by the pressure of the circumambient atmosphere alone, we shall have the following probabilities to bring us to a more rational conclusion.

"1st, That many opposite currents of wind, all pointing towards a certain centre, and coming in contact with each other with unequal forces, cause a rotatory motion or current of themselves round a central space, which, not partaking of an equal or its former pressure, naturally becomes rarified by the existing heat, to such an extent, that it speedily acquires a state in a great degree approximating to that of a vacuum. 2dly, This continued rotatory motion of the air, forms that which is usually denominated a *whirlwind*; and the pressure of the external atmosphere at the base, forcing the water to a reasonable height up the rarified space within, it is then carried upwards by the mechanical action of the wind, in light and unconnected streaks. The space at the bottom now becoming void, is regularly replenished by the pressure from without, till the whole spout is in due time thus perfectly completed.

"The water having now arrived at the region of the clouds, it is naturally attracted, diffused, and connected with and among them, increasing in density and extent, till the lower atmosphere becoming now lighter than the clouds above, these enormous masses gradually settling downwards, distend, burst, and dissipate in rain.

"Although this phænomenon was rather terrific in appearance, yet I am not inclined to think it would have been attended with any serious calamity to the ship, had even the whole quantity fallen on board, allowing the loftier sails to have been taken in, the hatches battened down, and the scuppers open. The cylinder or spout coming in contact with the masts and rigging, would naturally be destroyed; and the air rushing in instantaneously to restore the equilibrium, the torrent would be thus checked in its fall to the mere weight or force of a tropical descent. I have heard many reports of ravages committed by these aqueous meteors, but never yet met a perſon who had actually witneſsed or experienced any such distressing effects.

"In the formation of whirlwinds, there can be no fixed or determinate rule, why a preference should be given to their being generated at any one particular altitude between the clouds and sea, in preference to another; and if we take it for granted, that they are essential to the formation of water-spouts, or that a spout cannot exist without a previous whirlwind, it then naturally follows, that the dimensions of such a spout must, in a very great measure, depend upon the original proximity of the whirlwind to the sea itself, the sea affording a more copious supply of aqueous material, than the less substantial fabric of a cloud.

"The water that fell into the foot of the driver, on board the Erne, was certainly quite fresh to the taste, and it will be difficult to ascertain when and where the process of distillation was effected. In the mean time, however, it may reasonably be admitted, that the admixture of the salt-water from the sea, with the fresh-water in the clouds, the latter being in far greater proportion than the former, is of itself sufficient to account for the chemical change that had thus taken place in so short a space of time."

SCIENTIFIC INFORMATION.

Cauliflowers have been preserved two or three months by digging a trench under a wall, eighteen inches wide and deep, laying in the cauliflowers with the stems inclined upwards, and covering the whole in with earth, heaping up the surface in an inclined form, so that the rain should run off.

A very fine pearl was found not long since in the river Tay, and is supposed to be one of the finest ever found in Scotland. It is hardly to be surpassed either for size or beauty by any oriental pearl. It is in the possession of Mr. C. Murray, Jeweller, in Perth.

A subscription has been entered into at Geneva, to be applied to the purpose of repairing and warming the convent on the Grand St. Bernard. It appears, that its inhabitants, who are known over the whole of Europe, as having saved many a wanderer from destruction, amidst the snows and precipices of their inclement mountain, suffer severely in their health, from the damp and cold which prevail in their crazy mansion; they have, therefore, the strongest possible claims upon the charitable traveller.

A most singular circumstance occurred last week in the Charaib country, when some negroes, who were working near Sandy Bay, discovered an immense serpent, hitherto wholly unknown in any of these islands, and which was shot through the head by one of the party. It is supposed to be a species of *Boa* so common on the neighbouring continent, but in what way it reached the shores of St. Vincent is quite unknown. Its entire length was between fourteen and fifteen feet, the circumference of the body between three and four feet. When first seen, it was lying in a coil, but raised itself on being roused.—*Royal Gazette and Bahama Advertiser*, August 1821.

The Emperor Alexander has erected a magnificent observatory at Abo, in Finland, the direction of which has been given to the celebrated astronomer Balbeck.

Mr. E. Smith, from repeated trials made by himself and friends, strongly recommends the use of larch bark in tanning, not only for light calf, deer, or sheep skins, but for stout hides; and states, that sole-leather tanned with it, and worn against other leather tanned with vallonia, resisted the wear better, and did not imbibe so much water. He then asks whether there be any further occasion for the importation of Dutch or German bark.

Mr. Poenitz of Dresden, has lately experimented on the production of magnetism by hammering, friction, &c. and has come to the conclusion, perhaps before drawn, that it is not produced in the iron, but given to it by the external magnetism of the earth; all that the motion given to the iron in the various mechanical processes used, does, is to render it more susceptible of receiving magnetism. One of his modes of giving this motion to the particles, is to fix one end of a rod of iron or steel steadily, placing the rod in any position required, as either perpendicular or parallel to the dip, &c., and then to make it vibrate by drawing the free end from the axis of the rod, and suddenly letting it loose. If in a favourable position, the iron soon acquires magnetism.

A plan has been lately suggested, and will be acted upon at Edinburgh, for instructing by lectures and demonstrations, the operative mechanics of that city, in the principles of those branches of science which are useful in the various trades that are carried on there. Lectures on practical mechanics and practical chemistry will be delivered twice a week during the winter. A library has been formed, and the institution is conducted by a committee of fourteen, having a clerk and librarian. It is much to be desired that this plan were carried into execution in all the great towns of the United Kingdom, where it is possible: for efficacious as private interest has been found to be in improving the arts, yet there is no doubt that they must advance with the knowledge of the principles on which they are founded.

M. Gay-Lussac mentions, as the result of his experiments on the best means of rendering cloth incombustible, that solutions of muriate, sulphate, phosphate, and borate of ammonia, with borax, and some mixtures of these salts, were found the most effectual; in fact, according to his theory on the subject, those substances, which at the temperature of burning best shielded the fibre from the air, and supplied most incombustible gas or vapour to the flame, proved to be most efficacious.

It is announced in the *Journal de Medicina Pratique* of Berlin, that the Belladonna is a preservative against the scarlet fever. This fact was first discovered at Leipsig, but it has lately been confirmed by several experiments.

On the severity of the French *police Pharmaco-legale,* we may judge, when M. L—, a respectable apothecary of Verdun, has been recently fined 3,000 francs, for selling sulphuric acid to a woman, who poisoned herself with it.

M. Vogel of Munich, while spending some days on the banks of the Baltic, was told that different invalids, labouring under asthmas, &c., found themselves much better on sea than on shore. He then examined the air in different situations, and found that the sea air a league from shore, when admitted into an exhausted globe containing barytes water, did not trouble it, whereas the air, admitted into a similar globe on the shore, produced immediate turbidity. Nitrate of silver in solution, exposed to sea air, had some chloride formed in it. Hence he infers that the atmosphere of the Baltic, taken at a league from the shore, contains less carbonic acid than the ordinary atmosphere, and that it is probable the quantity of carbonic acid diminishes as we recede from the land 2nd, That the atmosphere of the Baltic contains muriates in greater or less quantity.

Dr. Siliman cautions chemists against making mixtures of chlorine and hydrogen in large quantities without due precaution. He relates some instances in which two or three quarts of the gases had been mixed, where the explosions produced on exposure to sunlight were instantaneous and very powerful, and one also in which the explosion took place by exposure of the gases to a very diffuse and dim light.

It is well known that weavers are obliged to work in damp shops, to prevent the dressing of the web from drying and hardening. M. Debue has read lately a Memoir before the Academy of Sciences of Rouen, on the subject of pastes, &c., in which he shews that a very minute addition of muriate of lime to them, renders them so retentive or absorbent of moisture, that webs dressed with such pastes, may be wove in the upper and drier chambers of a house, as well as in the lower and ill-aired with the usual dressing. The plan is undoubtedly judicious.

Musiate of lime may be had at a very trifling expence from those apothecaries who prepare water of ammonia. The waste whitening steep of the bleacher is merey a solution of muriate of lime.

In the second part of the Philosophical Transactions of the Royal Society, for 1821, an account is given of the skeleton of a large marine animal, sent to this country by Sir T. S. Raffles. It is the only one yet known that grazes the bottom of the sea without legs; being of the figure and form of a whale, the position and structure of its mouth enables it to browse upon the fuci and submarine algæ like a cow in a meadow, and the whole structure of the masticating and digestive organs, shews it to be truly herbivorous. It never visits land, or fresh water, but lives in shallow inlets, where the water is two or three fathoms deep. Their usual length is eight or nine feet. But a curious and, to some, perhaps the most interesting part of the history of this animal is, that the flesh resembles young beef, being very delicate and juicy; so that, as Sir Stamford, in the description of its dissection, remarks, "it afforded no less interest under the knife, than satisfaction on the table."

M. Sexullas has shewn, in the *Journal de Pharmacie* for September, that all the antimonial preparations used in medicine, except carefully chrystallized tartar emetic, contain more or less arsenic, which originally combined with the antimony in the ore, continues pertinaciously associated with it through all its modifications.

The best mode of ascertaining the mean density of the earth, is a point yet in dispute among philosophers. Dr. Hutton in a recent communication to the Royal Society, has suggested, that one of the pyramids in Egypt might profitably be employed instead of a mountain for this experiment; such a body, he says, offers several advantages; its mass is sufficiently large, standing upon a base of about the size of the whole space of Lincoln's-inn Fields, and of a height almost double of that of St. Paul's Steeple.

Professor Gazzeri states, as one of the results of his experiments on manures, that fresh vegetable matter, such as chopped straw, decomposes more rapidly into soluble manure, when mixed with soil in which plants are growing, than when left in soil in which no vegetation is going on. It also disappears sooner, being dissolved by the living powers of the vegetables, and carried into their circulation.

M. Gay-Lussac announced in the sitting of the Academy of Sciences, 6th Nov. 1820, that linen dipped in a solution of phosphate of ammonia became incombustible. MM. Mesat Guillot, father and son, apothecaries at Auxerres, have since shewn that the acidulous phosphate of lime possesses the same property. In fact, linen, muslin, wood, paper, straw, impregnated with a solution of this salt at 30° or 35° of concentration (1.26 to 1,30), and dried, became absolutely uninflammable, and consequently unfit to communicate fire. They carbonize, or char, when they are exposed to a very intense flame, but the carbonization does not extend beyond the focus of heat in which they are plunged.

Captain Kotzebue mentions the following circumstance respecting the Honey-Eater Bird. "The Hottentots, who have a very quick sight try to observe a bee flying home with its honey, and pursue it; but they often would not succeed following the bee, were they not assisted by the honey-eater birds, which perceive the intention of the men. The bird now pursues the bee, and gives the Hottentots, who pursue both, a signal by a whistle where the honeycomb is; and when they have taken out the honey, they throw some to the bird, as a reward for his service.

Mr. Maxwell says, that Elastic Gum, or *Indian Rubber*, is found in the countries of Congo and Loango, in Africa. The tree which produces this substance is very abundant. The gum, when first drawn from the tree, resembles cream, both in colour and consistence; and it is probably in this state that the South Americans run it upon bottle-shaped moulds. Upon exposure to the air, it quickly coagulates. The natives form it into foot-balls, which have an astonishing spring and elasticity and are admirably adapted for that purpose.

Snow of a *reddish tint* was found in the region of New South Shetland, as in the Arctic countries described by Captain Ross. It appears to owe its colour to some cryptogamic vegetable, probably of the same general nature as that described by Brown and Bauer, in their account of the red snow of the Arctic Highlands.

On the 6th December, 1815, Captain Kotzebue observed on the surface of the sea, near the Island of St. Catharine, a serpentine streak, about two fathoms broad, of a dark brown colour, which extended as far as the eye could reach. Upon examining it, it was found to be occasioned by an innumerable quantity of small crabs, and the seeds of a marine plant.

In the 96th page of our third volume, we gave some account of Mr. Barlow's discoveries on Magnetic Attraction. The following anecdote on the same subject, conveys a very elevated idea of our late venerable monarch's judgment and sagacity: — When Harrison's timekeeper was under trial at Richmond, it did not go as was expected. No one suspected the cause, till his late Majesty George III., who interested himself much about the machine, suggested that it was affected by a magnet, which was lying near it. The magnet was removed, and the timekeeper recovered its rate.

M. Westrumb is said to have found, that the salts of potash and soda, deprived of their water of crystallization, answer as well as the pure alkali for the manufacture of glass. In order to make an excellent glass, 24 parts of sulphate of soda are thoroughly dried, and mixed with 8 parts of powdered charcoal, and 16 of good white sand. The mixture must be calcined in the drying oven, until the sulphate is dissipated, and is then put into the pots for fusion.

M. Senefelder, the celebrated promoter of the lithographic art, has lately invented a kind of paper or card, as a substitute for the magnesian limestone usually employed. This card is covered on one or both faces with an argillo-calcareous mixture, which has the property of receiving the ink or the crayon in the same way that the stone does, and of undergoing the ordinary preparation, and furnishing impressions as neat and perfect as those obtained from designs traced on stone. Count Lasteyrie has examined and used this paper, and given a favourable report upon it.

On the 26th ult. an application was made to the Court of Chancery, by the celebrated surgeon Mr. Lawrence, for an injunction to restrain Mr. Smith, a bookseller in the Strand, from publishing a series of "Lectures on Physiology, Zoology," &c. delivered by the plaintiff at the Royal College of Surgeons in Lincoln's Inn-fields, it being contended that the copyright of such work was vested exclusively in the plaintiff. The ground upon which it was sought to dissolve the injunction was, that in many parts of the Lectures the *Immortality of the soul* was denied, and such denial being contrary to the Christian Religion and law of the land, did not entitle the plaintiff to the protection of the Courts of either law or equity in this country. The Lord Chancellor said, that any work which would not receive the protection of a Court of Law, would not be protected in that Court; and as it was questionable, whether a criminal proceeding would not lie against the original author, he should not discharge his duty if he did not dissolve the injunction, and refer the plaintiff to a Court of Law, when, if they considered the book justifiable, the plaintiff might have the injunction renewed.—Injunction discharged. The Court was much crowded by professional gentlemen.

AIR DIMINISHES IN WEIGHT IN THREE WAYS.

The law of contraries requires, that, by three ways, air may diminish in weight. These ways are the separation of any heavier foreign matter—its extension to more ample bounds,—and the abstraction of its heavier parts. The reader will observe, that this increase or diminution of weight, always refers to a portion of air compared with another of equal bulk. For when we do not take the volume of a substance into account, if we examine its weight by reason, I say that nothing gains weight but by the addition of matter, nor loses it but by its subtraction, so inseparably are matter and weight united. But if we investigate the subject by the balance, a case occurs in which, without any addition or subtraction of matter, a substance will appear more or less heavy; namely, by its contraction or expansion. Now this was the only mode of investigation known to the ancients when they contended that the elements, in their mutual conversion into one another, increase or diminish in weight in proportion as they increase or diminish in dimension, by the sole aid of nature, very expert in this operation—not that art is unable to increase or diminish the weight of things, dilating or contracting them. Hammer a piece of cold iron for a considerable time; you will unite its parts and diminish its bulk, and then it will appear heavier when put into the balance. Likewise, if you put a ball of feathers, closely tied up, into the scale, it will weigh more than when the feathers are left at their full size. From this I infer, what has been already cursorily touched on, that the balance is so fallacious, that it never indicates the true weight of substances, except when two portions of the same substance and figure, as two leaden bullets, are counterpoised against each other. But two ingots, one for instance of gold, and the other of iron, which appear by the balance to be equal, are nevertheless not so—for the iron is as much heavier than the gold, according to reason, as the air which it displaces is heavier than that displaced by the gold, which difference I cou'd shew exactly in every thing we weigh, and could reduce the whole to its just weight.—*Rey's Essays.*

ARUNDO ARENARIA.

This plant, which is generally known in Scotland by the name of *Bent*, in Gaelic *Muran*, is common on the coast wherever there is loose sand, which it serves to consolidate by its long tough roots. At Aberdeen it is manufactured into door mats, called Basses. It also makes excellent floor-brushes. In the Outer Hebrides, where it is plentiful, it serves many purposes in rural and domestic economy, being made into ropes for various uses, mats for pack-saddles, bags, mats, and vessels for preparing and keeping grain and meal; and, lastly, into hats. When made into meal vessels, it is bound together by its own slender and tough roots , but this should be prevented, as the digging for them loosens the sand. In Holland it is planted for the purpose of binding the sand, and this practice has been introduced among us by Mr. Macleod of the Herries, who has tried it extensively upon his estate.

RANUNCULUS FLAMMULA.

A very powerful epispastic, and known as such to the Hebridians, among whom it is in common use, under the name of *Lus-mor*. Applied in the form of cataplasm. the stalks and leaves being chopped small, and rubbed between two hot stones, it produces a blister in about an hour and an half. But its operation is rather violent, and on this account Cantharides are preferable, unless in cases where it is of importance to procure a blister in the most expeditious mann e

EXTRAORDINARY CAVE IN INDIANA.

In the Appendix to the first volume of the Archæologia Americana is given the following account of a great and extraordinary Cave in Indiana. It is addressed, as a letter, by Mr. Benjamin Adams to John H. Farnham, Frankfort Ohio, in the United States of North America.

"The cave is situated in the north-west quarter of section 27. in township No 3. of the second easterly range in the district of lands offered for sale at Jeffersonville. The precise time of its discovery is difficult to ascertain. I have conversed with several men who had made many transient visits to the interior of the cave about eleven years ago, at which time it must have exhibited a very interesting appearance, being, to use their own phraseology, *covered like snow* with the salts. At this period some describe the salts to have been from six to nine inches deep, on the bottom of the cave, on which lumps of an enormous size were interspersed, while the sides presented the same impressive spectacle with the bottom, being covered with the same production. Making liberal allowances for the hyperbole of discoverers and visitors, I cannot help thinking that the scenery of the interior, at this time, was highly interesting, and extremely picturesque. I found this opinion upon conversations with General Harrison and Major Floyd who visited the cave at an early period, and whose intelligence would render them less liable to be deceived by novel appearances.

The hill, in which the cave is situated, is about four hundred feet high from the base to the most elevated point; and the prospect to the south-east, in a clear day, is exceedingly fine, commanding an extensive view of the hills and valleys bordering on Big Blue River. The top of the hill is covered principally with oak and chesnut. The side to the south-east is mantled with cedar. The entrance is about midway from the base to the summit, and the surface of the cave preserves in general about that elevation; although I must acknowledge this to be conjectural, as no experiments have been made with a view to ascertain the fact. It is probably owing to this middle situation of the cave, that it is much drier than is common.

"After entering the cave by an aperture of twelve or fifteen feet wide, and in height, in one place, three or four feet, you descend with easy and gradual steps into a large and spacious room, which continues about a quarter of a mile, pretty nearly the same in appearance, varying in height from eight to thirty feet, and in breadth from ten to twenty. In this distance the roof is, in some places, arched; in others a plane, and in one place, particularly, it resembles an inside view of the roof of a house. At the distance above named the cave forks; but the right hand fork soon terminates, while the left rises by a flight of rocky stairs, nearly ten feet high, into another story, and pursues a course, at this place, nearly south-east. Here the roof commences a regular arch, the height of which, from the floor, varies from five to eight feet, and the width of the cave from six to twelve feet; which continues to what is called the *Creeping Place,* from the circumstance of having to crawl ten or twelve feet into the next large room. From this place to the "PILLAR," a distance of about one mile and a quarter, the visitor finds an alternate succession of large and small rooms, variously decorated; sometimes mounting elevated points by gradual or difficult ascents, and again descending as far below; sometimes travelling on a pavement, or climbing over huge piles of rocks, detached from the roof by some convulsion of nature,—and thus continues his route, until he arrives at the Pillar.

"The aspect of this large and stately white column, as it comes in sight from the dim reflection of the torches, is grand and impressive. Visitors have seldom pushed their inquiries farther than two or three hundred yards beyond this pillar. This column is about fifteen feet in diameter, from twenty to thirty in height, and regularly reeded from the top to the bottom. In the vicinity of this spot are some inferior pillars, of the same appearance and texture. Chemically speaking, it is difficult for me to say what are the constituent parts of these columns, but lime appears to be the base. Major Warren, who is certainly a competent judge, is of opinion that they are satin spar.

"I have thus given you an imperfect sketch of the mechanical structure and appearance of the cave. It only remains to mention its productions.

"The first in importance is the Sulphate of Magnesia, or Epsom Salts, which, as has been previously remarked, abounds throughout this cave, in almost its whole extent, and which I believe has no parallel in the history of that article. This neutral salt is found in a great variety of forms, and in many different stages of formation. Sometimes in lumps, varying from one to ten pounds in weight. The earth exhibits a shining appearance, from the numerous particles interspersed throughout the huge piles of dirt collected in different parts of the cave. The walls are covered in different places with the same article, and reproduction goes on rapidly. With a view to ascertain this fact, I removed from a particular place every vestige of salt, and in four or five weeks the place was covered with small needle-shaped crystals, exhibiting the appearance of frost.

"The quality of the salt in this cave is inferior to none; and when it takes its proper stand in regular and domestic practice, must be of national utility. With respect to the resources of this cave, I will venture to say, that every competetent judge must pronounce it inexhaustible. The worst earth that has been tried, will yield four pounds of salt to the bushel; and the best from twenty to twenty-five pounds.

"The next production is the Nitrate of Lime, or saltpetre earth. There are vast quantities of this earth, and equal in strength to any that I have ever seen. There are also large quantities of the Nitrate of Alumina, or nitrate of argil, which will yield as much nitre of potash, or saltpetre, in proportion to the quantities of earth, as the nitrate of lime.

"The three articles above enumerated are first in quantity and importance; but there are several others which deserve notice, as subjects of philosophical curiosity. The Sulphate of Lime, or plaster of Paris, is to be seen variously formed; ponderous, crystallized and impalpable or soft, light, and rather spongy. Vestiges of the sulphate of iron are also to be seen in one or two places. Small specimens of the carbonate, and also the nitrate of magnesia, have been found. The rocks in the cave principally consist of carbonate of lime, or common limestone.

"I had almost forgotten to state, that near the forks of the cave are two specimens of painting, probably of Indian origin. The one appears to be a savage, with something like a bow in his hand, and furnishes the hint, that it was done when that instrument of death was in use. The other is so much defaced, that it is impossible to say what it was intended to represent."

POETRY.

ODE TO TWILIGHT.

There is a something which I cannot paint:
But often feel, and when I felt it last,
'Twas strongest,—'tis to trace the faint
And shadowy recollections of the past:—
To think on days of pleasure gone,
To think on deeds of pleasure done,
To think of happiness no more
Our own, and all the varied store
Which life possesses:—
To think on those we loved the best
Who now from care and sorrow rest;
To dive into the deep recesses
Of mind and memory, thence to draw
Subject for thought, and this I saw
When I was young, and fain
Would after see again.
Yet 'tis not at every time,
We feel its mighty power;
But most of all in the twilight hour,
When day and evening chime
Together, and when the wind is still,
When the air is calm, and the murmuring rill,
Trickling along the ground,
Utters a melancholy sound;
When the flowers conceal their colouring,
Folding their beauteous leaves,
And the singing race has ceased to sing,
'Tis then that fancy weaves
Her magic web, and to the mind
Brings back tales remembered not,
And stories far behind,
Which long ago had been forgot.

SIMON DE MONTFORT.

ANSWERS

TO THE

QUESTIONS FOR YOUTH,

Proposed in the First Number of the Fourth Volume.

(1) *By* Master C. BARTHOLOMEW.

By selling a gold repeater for 60 guineas I shall gain twice as much per cent as if I sold it for 50 guineas: What was the prime cost?

By Master MICHAEL SCHOFIELD.

Put $x =$ the prime cost of the repeater; then $1 : 2 :: 50 - x : 60 - x$. Hence $x = 40$ guineas.

By Masters S. P. HOUGHTON, *and* R. HATTERSLEY.

Here 60 guineas — 50 guineas = 10 guineas = the difference of the gains, as is evident. Moreover, by the nature of Profit and Loss, it appears, that the ratio of the gains, at the selling prices, will be the same as those per cent; hence, we shall have given the difference of the gains 10 guineas, and their ratio as 2 : 1, to find them. Consequently, it will be as $(2 - 1)\ 1 : 1 ::$ 10 guineas : 10 guineas = the gain by selling it at 50 guineas. Therefore 50 guineas — 10 guineas = 40 guineas, the prime cost required.

(2) *By* Master JOHN DEAKINS.

The hypothenuse of a right angled plane triangle, whose angles are in arithmetical progression, is 100: Find the other two sides.

By Masters J. DEAKINS, *and* H. LEPPINGTON.

Divide the sum (180°) of the three angles in the proportion of 1, 2, 3, and we get the angles = 30°, 60°, and 90° respectively, or the △ half an equilateral one. Therefore the less leg will be equal t half the hypothenuse $= 50$; consequently the other leg $= \sqrt{(100^2 - 50^2)} = \sqrt{7500} = 86.60254$ as required.

By Master WILLIAM WALKER RILEY.

The angles are evidently 30°, 60°, and 90°; therefore rad. $= 1 : 100 ::$ sin. $30 = \frac{1}{2} : 50 ::$ sin. $60 = \frac{1}{2}\sqrt{3} : 86.60254$. Whence 50 and 86.60254 are the two sides required.

(3) *By* Master W. CADMAN.

A vessel in the form of a conic frustrum will hold 19 gallons of ale; its top diameter is 18 inches, and its depth 23 inches and a half: Find the bottom diameter.

By Master ABRAM JOHNSON.

Put $c = 19 \times 282 = 5358$, the cubic inches in 19 gallons, $n = .7854$, $a = 23\frac{1}{2}$ the altitude, $b = 18$ in. the top diameter, and $x =$ the bottom diameter; then, per Mensuration, $(b^2 + x^2 + bx) \times (an \div 3) = c$, or $x^2 + bx = 3c \div an - b^2$; whence $x = \sqrt{\left[\frac{3c}{an} - \frac{3b^2}{4}\right]} - b \div 2 = 16.0578$, the bottom diameter required.

(4) *By* Master R. ANDERSON.

In what latitude on the longest day will Castor rise with the sun?

By Master C. BARTHOLOMEW.

Here $90° - 23° 28' = 66° 32' =$ sun's co-declination, and $90° - 32° 16' = 57° 44' =$ Castor's co-declination.

$$\begin{array}{rl} & 110° \ 31' = \text{Castor's right ascension.} \\ & \underline{90° \ \ 0'} = \text{Sun's right ascension.} \\ \text{Diff.} & \underline{\underline{20° \ 31'}} = \text{angle at the pole.} \end{array}$$

As co-sine $\frac{66° 32' + 57° 44'}{2} = 62° 8'$: co-sine $\frac{66° 32' - 57° 44'}{2} = 4° 24'$ :: co-tangent $\frac{20° 31'}{2} =$

10.15½ : tan. 85° 9' = ½ sum of the other two angles. As sin. 62° 8' : sin. 4° 24' :: cot. 10° 15½' : tan. 25° 37' = ½ diff. of ditto. 85° 9' — 25° 37' = 59° 32' = angle opposite to the co-declination of Castor. As rad. : sin. (180°—59°32') = 120° 28' :: sin. 66° 32' : sin. 52° 14$\frac{7}{10}$' = latitude N. required.

⁂ Master John Deakins finds by the globe the lat. 52¼° North.

(5) *By* Master JOHN MACAULEY.

Given $x^{4n} - 2x^{3n} + x^n = 6$ to find x, by quadratics.†

† See Bonnycastle's Algebra, 10th Edition.

By the Proposer and Master S. PEARSON.

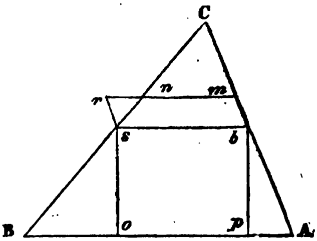
By transposition $x^{4n} - 2x^{3n} + x^n - 6 = 0$. Divide each side by $x^{2n} - x^n + 2$. Then $x^{2n} - x^n - 3 = 0$, or $x^{2n} - x^n = 3$ by transposition. Complete the □, $x^{2n} - x^n + \frac{1}{4} = \frac{13}{4}$. Extract the root, $x^n = \frac{1}{2} \pm \sqrt{\frac{13}{4}}$; Hence $x\ {}^{n}\sqrt{\frac{1}{2}} \pm \frac{1}{2}\sqrt{13}$ as required.

(6) *By* Master J. LENS.

Given the vertical angle, ratio of the sides, and a side of the inscribed square, to construct the plane triangle.

By Master C. BARTHOLOMEW.

Draw two indefinite right lines CA, CB, including the given angle, in which take C*n* to C*m* in the given ratio of the sides; join *mn*, in which produced, if necessary, take *rm* equal to the side of the square. Draw *rs* parallel to CB, cutting AC in *s*; draw *sb* parallel to *rm*, meeting CB in *b*; complete the square *ospb*; produce *op* to meet CA, CB in A, B. Then is ABC the required triangle. For, by similar triangles, AC has to BC the same ratio which



Cn has to Cm, that is, the given ratio; also the $\angle$ ACB and the side of the inscribed square. Q.E.D.

(7) *By* Master W. Cadman.

A grazier sold a certain number of oxen for 99 guineas, and had he sold four less for the same sum, he would have received a guinea a piece more for them: Required the number sold.

By Masters S. P. Houghton, *and* Joseph Sharp.

Put $x =$ the number of oxen sold; then $(99 \div x - 4) - (99 \div x) = 1$ by the question; or $x^2 - 4x = 396$ by reduction. Complete the square, $x^2 - 4x + 4 = 400$. Extract the root, $x - 2 = 20$. Hence $x = 22$, as required.

(10) *Prize Question, by* Amicus.

(8) *Taken from the Arithmetical Grammar, lately published.*

In an Arabian manuscript was found this remarkable decision.—Two Arabians sat down to dinner; one had 5 loaves, the other had 3; a stranger, passing by, desired permission to eat with them; to which they agreed. The party having finished their loaves, the stranger laid down 8 pieces of money and departed. The proprietor of the 5 loaves took up 5 pieces, and left 3 for the other, who objeeted and insisted on half. The cause came before Ali, the chief magistrate, who gave the following judgment:—Let the owner of the 5 loaves have 7 pieces, and the owner of the 3 loaves 1. Was this decision just?

By Master Jonathan Horner.

Here, if we suppose each person to eat an equal quantity, and that 8 pieces is the value of each quantity; then, since there are three persons, and each person's share 8 pieces, therefore $3 \times 8 = 24$ pieces, the value of the quantity which the three persons eat; but the number of loaves is 8, therefore $24 \div 8 = 3$ pieces, the value of each loaf. Hence the value of 5 loaves $= 15$ pieces; but since the owner's share is 8 pieces, therefore $15 - 8 = 7$ the number of pieces the owner of the 5 loaves ought to have, and $8 - 7 = 1$ piece, which the owner of the 3 loaves ought to have. Therefore the decision was just.

By Masters S. SIMPSON, *and* W. WALKER RILEY.

First, let A denote the proprietor of 5 loaves, B that of 3, and S the stranger. Then $8 \div 3 = 2\frac{2}{3}$ = the number of loaves each person consumed. Therefore $5 - 2\frac{2}{3} = 2\frac{1}{3}$ loaves, the quantity S ate of A's loaves; and $3 - 2\frac{2}{3} = \frac{1}{3}$ of a loaf, the quantity S ate of B's loaves. Therefore by single fellowship, $2\frac{1}{3} + \frac{1}{3} = 2\frac{2}{3} : 8$ pieces $:: 2\frac{1}{3} : 7$ pieces $:: \frac{1}{3} : 1$ piece, which verifies Ali's decision.

Ingenious solutions to all the questions in the Youths department were transmitted by Masters C. Bartholomew, Bradford; R. Hattersley, Chapelthorp, near Wakefield; and Jonathan Horner, Knaresbro'.

J. Myres, Portland-Street, Soho, answered 1, 2, 5, 6, 7, and 8.

Master J. Deakins, Woodhouse-Grove Seminary, answered 1, 2, 3, 4, and 8.

Michael Schofield, Knaresbro', answered 1,2,3,6,7, and 8.

B. Kimp, Tamerton-foliot, answered 2, 3, 5, 6, and 7.

Hildyard Leppington, Woodhouse-Grove Seminary, answered 1, 2, 4, and 8.

Samuel Pearson Houghton, at Mr. J. Brierley's Seminary, Brindle, near Blackburn, answered 1, 3, 5, 7, and 8.

Joseph Sharp, Leeds, answered 1, 2, 7, and 8.

Samuel Simpson, Woodhouse-Grove Seminary, and W. Walker Riley, Pupil at Trinity Church School, Preston, answered 1, 2, and 8.

Abraham Johnson, pupil at Cuerden School, near Preston, answered 1, 2, 3, and 7.

J. Macauley answered 2 and 5.

J. Lens answered 2 and 6.

The communications of several of our young friends arrived too late to be noticed in this list.

ANSWERS

TO THE

MATHEMATICAL QUESTIONS

Proposed in the First Number of the Fourth Volume.

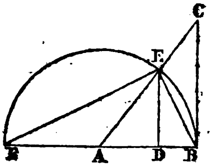
Six numbers of the Leeds Correspondent are now and will be hereafter regularly offered as a prize, to be adjudged BY LOT, to one Gentleman out of those who may give true solutions to the Prize Question in each number.

Mr. Swale of Liverpool, who has answered the Prize Question in this Number, and on whom the lot fell for the Prize, will have the goodness to apply, either personally or by letter, to Mr. John Heaton, Bookseller, Briggate, Leeds, and he will receive six copies of this Number gratuitously, as allotted to him.

(241) *By* Mr. W. Wright.

Given the rectangle under the sine and tangent of an arc, and the rectangle under the chord and sum of the sine and tangent, to find *geometrically* the radius.

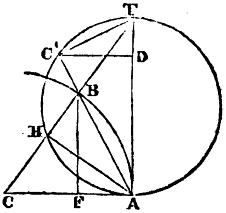
By Mr. W. Shepherd.



Let BC, BE, DE be the tangent, chord, and sine to radius AB; then, by similar triangles, BC : DE :: AB : AB — DB; componendo et alternando, BC + DE : BC :: 2AB — DB : AB; and, by sim. tri., BE : 2AB :: DB : BE. Whence, compounded by (BC + DE), BE : 2AB.BC :: (2AB — DB) . DB = DE² : AB.BE, or BE : ED :: 2BC

. DE : (BC + DE) BE. Now the consequents are given by the question; therefore the ratio of BE to DE is given, and of course the right-angled triangle BDE is given in species; therefore the triangle ADE, or ABC, is given in species; ergo, the ratio of DE to BC is given, and since the rectangle DE . BC is given, DE and BC become known (by prob. 10, Student,) and consequently the radius AB required.

By Mr. Jesse Winward.



Geom. Analysis.—Admit the problem solved and AC the required radius, AB the arc, AT the tangent, CT the secant, AB the chord, and BF the sine; draw AH perpendicular to CT, and upon AT as a diameter describe a circle, and produce AB to meet it at C′; join C′T, and draw C′D perpendicular to AT. By the problem we have given BF . AT and AB . (BF + AT) to determine the radius CA or CB. Obviously, the right-angled triangles BCF, ACH are similar and equal in every respect; therefore ∠ HAT = ∠ HCA, being the complements of the equal ∠s HAC, CBF; but ∠ BAT = ½ ∠ BCA, (Euc., Book iii, 21, 32.) therefore ∠ BAT = ½ ∠ HAT, or ∠ HAB = ∠ BAT. Wherefore, by a well-known proposition, AD = ½(AH + AT), and the right angled triangles BAH, CDA are similar, and evidently AH = BF; hence AH (BF) : AB :: AD : AC′, or AH . AC′ = AB . AD = a given space by the problem, and AH . AT = a given space; but AH . AT : AH . AC′ :: AT : AC′ a given ratio, because the two first terms are given. Therefore the right-angled triangle AC′T is given in species, as is the triangle BAH also, from which the triangle HTA is evidently given in species and AT : AH a given ratio but AH . AT is given. Therefore AH and AT are given, per lineal sections, hence this simple and evident Construction:—

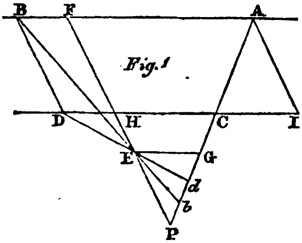
With AT, AH, as determined per analysis, construct the right angled triangle AHT, draw AC perpendicular to AT and produce TH to meet AC in C, and AC is the radius required.

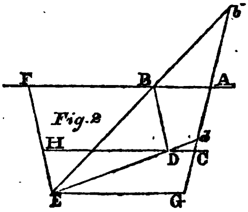
Solutions were also received from Messrs. Baines, Stringer, Longbottom, Holt, Bartholomew, Swale, Settle, and Inexpertus.

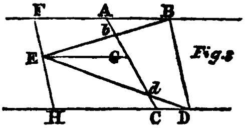
(242) *By* Mr. J. H. Swale.

"Given in position, four straight lines AB, CD, EF, AC, of which AB, CD are parallel, and E a given point: it is required to find the place of BD parallel to EF, so that the distance KL in AC intercepted by BE, DE may be a maximum."

By Plus Minus.







This question was proposed in No. 21 of the Gentleman's Mathematical Companion for 1818, by Mr. P. Nicholson. The following solution, drawn up soon after the publication of that Number, differing considerably in method from the proposer's solution in the succeeding Number, may not be unacceptable. As the figure is adapted to the original question, I shall transcribe it in the proposer's own words.

"Given in position four straight lines AB, CD, EF, and AC, of which AB and CD are parallel to each other, and E a fixed point: it is required to find the place of BD parallel to EF, so that the distance *bd* in AC or AC produced, intercepted by the right lines BE and DE, may be the greatest possible."

SOLUTION.—Draw AI (Fig. 1.) parallel to EF or BD meeting DC in I, and EG parallel to DC or AB meeting AC in G; then, by similar triangles, $Gd : GE :: Cd : CD = Cd . GE \div Gd$, and $Gb : GE :: Ab : AB = Ab . GE \div Gb$. Hence $\left\{\frac{Ab}{Gb} - \frac{Cd}{Gd}\right\} . GE = AB - CD = CI$, or $(Ab . Gd - Cd . Gb) \frac{GE}{CI} = Gb . Cd.$ (1) Put $AG = a$, $CG = b$, $GE \div CI = m$, $Gd = x$, $bd = y$; then $Ab = a + x + y$, $Gb = x + y$, $Cd = b + x$. Whence, by substitution, equation (1) becomes $[(a + x + y) . x - (b + x) . (x + y)] . m = xy + x^2$; which gives $y = \frac{max}{bm + x} - x$ (2); the fluxion of which put $= 0$, there results $x = m[\surd(ab - b)]$ a value that determines the position of BD on the left of EF, when the intercepted part *bd* is a maximum. But if BD be supposed to lie on the right of EF, between EF and AC, (Fig. 2.) so that the points *b*, *d* may lie above the line EG, then x and y will be negative, and equation (2) becomes $y = \frac{max}{bm - x} - x$; from which it appears that when $x = bm$, the value of y is infinite.* Lastly, if BD lie on the right of AC, (Fig. 3.) and the given point E between the straight lines AB and CD, the signs of x, b in the same equation (2) must be written negative, which gives $y = \frac{max}{bm + x} + x$. The fluxion of this equation put $= 0$ and reduced, we get the imaginary quantity $x = m\surd - ab - mb$, which indicates that the value of y or of *bd* do not, in this case, admit of either a maximum or a minimum.

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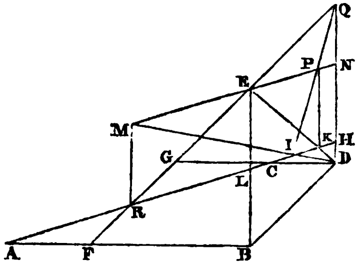
* This happens when the straight line EB is parallel to AC.

By the Proposer.



Suppose the position of BD, making KL a maximum, to be determined. Draw DQ, KP parallel to BE, meeting AC, EF, and EN a parallel to EF at H, Q, N, P; let AC intersect EF at R, DC at C, and QP at I; draw DI, meeting NE at M, and join R, M.

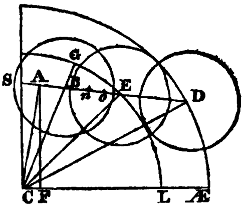
Because of pars., $EQ = BD = FG$ equal a given line, or Q a given point; also $QE : QR = EP : RI = PN : IH = KH : IH = EN : MN =$ a given ratio, and $PE = KL$ a maximum. Therefore RI, and of course CI, is a maximum; and RM, obviously, parallel to QN or QD.

The points Q, R, and the lines CD, NM, CI, are therefore given in position, to draw the parallels QD, RM, meeting CD, NM in D, M so, that drawing DM intersecting CI in I, the segment CI shall be a maximum; which forms the second case of the preceding problem.

(243) *By* Miss Ann Nichols, *of Hadham.*

One night I made observation of an eclipse of the moon, but clouds interposing I could not see the beginning; however, some time after, it cleared up, and at 9h. that evening I observed her to be exactly 6 digits eclipsed on her lower limb: at 9h. 36m. 22s. the digits eclipsed were 10° 18′, and then clouds appearing again prevented all further observation. By calculation I found the semi-diameter of the moon 16m., her latitude at the middle 30m. north, and her horary motion from the sun 33m. From this curious observation the beginning, middle, and end of the eclipse may be found *geometrically*, and are here required.

By Mr. W. SETTLE.

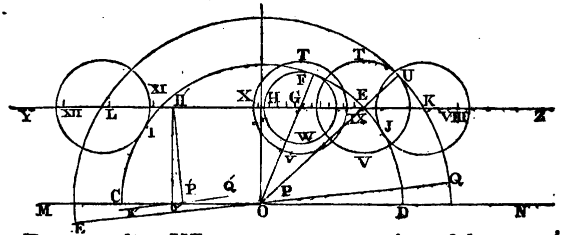


Let ABED and CFLÆ represent the portions of the lunar orb and the ecliptic; E,B the places of the moon's centre at the first and second observations; and AF (30′) her lat. at the middle of the eclipse. Then the angle CAF being found = 5° 15′ (from Astronomical Tables,) CA will be found = 30.12638′; and 60′ : 33′ (the given horary motion) :: 36′ 22″ (the time between the observations) : $20\frac{1}{600}'$ = EB. Also 6 dig. : 16′ (the ☽'s semi-diam.) :: 4 dig 18m. : 11.466 = BG. Hence the following ANALYSIS:—

In EB take E*o* a third proportional to EB and BG, bisect B*o* in *n*, then (by lemma, page 222, Simp. Geom. Edit 3d.) A*n* : BC :: BG : BE. Therefore, because BG,BE are given, A*n* : BC, and also B*n* will be given. In AB produced take AS = B*n*, and join CS, which (by Euc. 47, 1.) will be given, as will also the ∠ ASC. Hence, we have given, the base CS, the ∠ CSB at the base, and the ratio of the sides BS (= A*n*) to CB, to determine BC, &c.

COMPUTATION.—First, $BG^2 \div BE = Eo = 6.5736'$. Hence, B*n* = AS will be found = 6.7132′ and (per Euc. 47, 1.) CS = 30.89′. Therefore in the right angled triangle SAC, there are given all the sides to find the ∠ ASC = 77° 14′ 1″. Also in the triangle BSC there are given, the ratio of the sides BS : BC, the ∠ ASC, and the side SC, to find the ∠ SCB = 33° 59′ 52″, and thence the sides BC = 32.32′ and BS = 18.5301. Whence AE = 31.8169′, CE = CG = 43.786′, (the semi-diam. of the ⊕'s shadow,) and the measure of the semi-duration AD = 51.64; and thence are readily deduced 8h. 23m. 58 sec., 9h. 57m. 51 sec., and 11h. 31m. 44 sec., for the beginning, middle, and end of the eclipse.

By Mr. C. Holt.

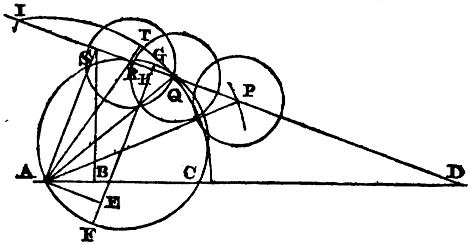


Draw any line YZ to represent a portion of the moon's orbit; from any point H′ in YZ draw the indefinite perpendicular H′O′; make the $\angle$ O′HP $= 5\frac{o}{4}$, the inclination of the ☽'s orbit to the ecliptic; take, from a convenient scale, 30m. or parts, and apply it from H′ to P′; then draw Q′P′O′E′ perpendicular to H′P′, to represent a parallel to a portion of the ecliptic; through O′ draw MO′N parallel to YZ; take from the same scale 33m., the ☽'s horary motion, and with it set off the hour divisions in the line YZ, viz. at VIII, IX, X, XI, XII, one of which (as IX, or X,) divide into 60 equal parts for minutes of an hour; take now 16m. the moon's semi-diameter, and with E or IX as a centre, describe the circle TV to represent the moon when the first observation was made; with the same radius and centre G, 36m. 22 sec. from E, describe the circle TV to represent the ☽ when the second observation was made. Again, take $11.466' = \left(\frac{(10°18'-6°)\times 16}{6°}\right)$ with which as a radius and centre G describe the circle WF, the circumference of which circle must evidently touch the boundaries of the earth's penumbra. Now, (by prob. 76, App. Simp. Algebra,) construct the triangle GOE upon the given base GE, to have the difference of its sides equal to the given line GF, and perpendicular equal to H′O′; then the point O in the line MN will be determined, and will evidently be the centre of the representation of the earth's penumbra, from which as centre with radius equal OE describe the semi-circle DEFIC, and from the same centre and radius equal to OE + EU (the moon's semi-diameter) describe the semi-circle QULE to intersect YZ in K and L; through O, parallel to E′O′Q′, draw EOQ, and it will represent a portion of the ecliptic; draw OH parallel to O′H′; then K will represent the beginning of the eclipse, H the middle, and L the end.

By measurement, or by inspection of a diagram large enough and rightly drawn, the point K, or the beginning, will be at 8h. 23 min. 50 sec. nearly; H, or the middle, will be at 9h. 57 min. 50 sec. nearly; and L, or the end, will be at 11h. 31 min. 50 sec. nearly.

The CONSTRUCTION is too evident to one that is acquainted with the geometrical representation of eclipses to need demonstration, which would take up too much room.

By Mr. W. WRIGHT.



SOLUTION.—Let ABCD represent the ecliptic, DI the moon's path, P the moon's centre at the beginning of the eclipse, Q that at the first observation, R that at the second; draw AP, AQ, AR, also AS perpendicular to DI, and BS perpendicular to AD; then, by right angled triangles and astronomy, the ∠ ASB = ∠ ADI = 5h. 15′, and BS (the moon's latitude at the middle of the eclipse,) = 30 min. is given. Whence AS is found 30.1517′; likewise as 1 hour : given horary motion :: time between observations : QR = 20′, and as 6 digits (the part eclipsed at the first observation) : given semi-diameter of the moon :: 4h. 18′ (the excess of the digits eclipsed at the last observation) : 11.466′ = RT = AQ — AR. Now, through A, Q, R describe a circle, draw the diameter GF perpendicular to DI, bisecting QR at H; also draw AE perpendicular to FG; then, from the last of my theorems on page 46, No. 24, Math. Comp., $4EH \times GH = QR^2 - RT^2$ = a given space; and as $EH = AS$ is given, GH becomes known; also $FH \times GH = RH^2 = \frac{1}{4}QR^2$; therefore FH is known, and as follows a CONSTRUCTION:—

Having in the Analysis found $AS = EH$, QR, and $AQ - AR$, find (by lineal sections) GH so that $4EH \times GH = QR^2 - TR^2$, and EF so that $FH \times GH = \frac{1}{4}QR^2$; upon FG as a diameter describe a circle; through H and E, perpendicular to FG, draw QR, EA; cutting the circle at Q, R and A, draw AQ, and to centre A and radius AP (= AQ + radius of the moon) describe an arc cutting RQ produced at P, the moon's centre at the beginning of the eclipse, Q, R being the places of the centre at the first and second observations.

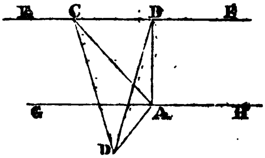
CALCULATION.—By means of the above cited theorem, GH is found = 2.23′, also $GH \times FH = RH^2$; hence FH = 44.84′: whence EF = 14.6883′, also EG = 32.38′. Therefore AE = HS = 21.84′, and QS = 31.84′; whence AQ = 43 84′ the radius of the earth's shadow, and PS = 51.71′ = half duration of the eclipse, which, in time, is 1 hour 33 min. 50 sec; from which we easily find 8h. 23 min. 54 sec. the beginning, 9h. 57 min. 54 sec. the middle, and 11h. 31 min. 54 sec. the end of the eclipse.

⁂ Plus Minus reduces this question to the 222d of our last No.; and from the first solution to that question, he very readily finds the times of the beginning, middle, and end of the eclipse the same as those found by Mr. Wright.

(244) *By* PLUS MINUS.

On the day of the autumnal equinox (1820) I and a friend set about drawing a meridian line on a horizontal plane, and having described several circles concentric to a gnomon perpendicularly erected thereon, we very accurately marked before and after noon the points where the extremities of the shadows terminated in the circles, and found them all to be in one and the same right line. Was the construction true?

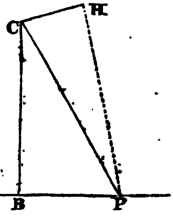
By Mr. W. Wright.



Solution.—Let AD represent the gnomon perp. to the horizon at A, AB the meridianal shadow, draw DB. Now, by spherics, if radius = unity, then tangent sun's alt. = $\dfrac{1}{\text{tang. lat.} \times \text{cos. azim.}}$, and by Plain Trig. $\dfrac{AD}{\text{tang. lat.} \times \text{cos. azim.}}$ = length of the shadow. Again, by spherics, AD × cos. lat = AB, the meridianal shadow; through B draw an indefinite right line EF perpendicular to AB, also draw AC meeting EF at C, making the $\angle$ BAC = sun's azimuth; then, by Plane Trig. $\dfrac{AB}{\text{cos. BAC}} = \dfrac{AD \times \text{cos. lat.}}{\text{cos. azim.}}$ = AC; but comparing this with the expression for the length of the gnomon's shadow, it will readily be found that they are identical, for expunging like terms from both, there remain (1 ÷ tang. lat.) and cos. lat., which by a known Trigonometrical formula are equal; consequently the expressions from which they are derived are also equal; and the extremity of the shadow will always be found in the right line EF.

*** In the above solution no regard has been paid to refraction nor variation of declination.

By the Proposer.



Let CH represent the gnomon, CB its shadow when the sun is on the meridian, CP its shadow at any other time of the given day, PB being perpendicular to CB, and PH the direction of the solar ray.

When the sun is in the equinoctial the co-sine of his azimuth is equal to the tangent of the latitude multiplied by the tangent of his altitude; but co-sine azimuth

= co-sine ∠ PCB = BC ÷ PC, and tan. alt. = tan. ∠ CPH = CH ÷ CP. Hence BC ÷ PC = tan. lat. × (CH ÷ CP); therefore BC = tan. lat. × CH, and since CH, the height of the gnomon, and the latitude are given, BC is given, and consequently the locus of the point P is the right line BP given in position.

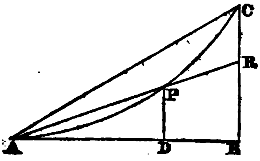
⁂ This solution supposes the sun to continue 90° from the pole during the day of the equinox; but as that is only the case at one particular instant of time, the locus of P would *not be a straight line,* but *a very long hyperbola,* differing however so little from a straight line as not to be perceptible.

Solutions were also received from Messrs. Hattersley, Baines, Holt, and Settle.

(245) *By* Mr. S. Johnson.

ABC is a right angled plane triangle of which the base AB is given equal 100, and in AC, the variable hypothenuse, AP is continually taken equal to double of BC, the perpendicular. It is required to determine the equation, quadrature, and rectification of the curve which is the locus of the point P.

By Mr. S. Ryley, *Leeds.*



1. Let AB $= a = 100$, AD $= x$, and PD $= y$; then by the similar triangles APD, ARB we have AD : DP :: AB : BR $= \frac{ay}{x}$, and $\sqrt{(x^2+y^2)} = \frac{2ay}{x}$, or $x^4 + x^2y^2 = 4a^2y^2$. Hence $y = \frac{x^2}{\sqrt{(4a^2-x^2)}}$; then $yx' =$

$\frac{x^2x'}{\sqrt{(4a^2-x^2)}}$ whose fluent (Hutton's Course, p. 235, Vol III.) is $a \times$ cir. arc, radius $2a$ and sine $x - \frac{1}{2}x\sqrt{(4a^2-x^2)}$, which when $x = a$ will be $a \times$ cir. arc, rad. $2a$ and sine $a - \frac{a^2}{2}\sqrt{3} = a \times$ (arc of 30° to R. $= 2a) - \frac{a^2}{2}\sqrt{3} = 100 \times 104.72 - 5000\sqrt{3} = 1812$ = area of the space APCBA nearly.—2. The fluxion of $y = \frac{x^2}{\sqrt{(4a^2-x^2)}} = \frac{8a^2xx' - x^3x'}{(4a^2-x^2) \cdot \sqrt{(4a^2-x^2)}}$; therefore $z' = \sqrt{(x'^2+y'^2)} = 2ax'\sqrt{\left\{\frac{16a^4+4a^2x^2-x^4}{(4a^2-x^2)^3}\right\}}$

$$= 2ax' \times \sqrt{\left\{\frac{1}{4a^2} + \frac{x^2}{4a^4} + \frac{x^4}{8a^6} + \frac{13x^6}{256a^8} + \frac{19x^8}{1024a^{10}} + \frac{26x^{10}}{4096a^{12}} + \frac{34x^{12}}{16384a^{14}} + \frac{43x^{14}}{65536a^{16}} + \&c.\right\}}$$

$$= 2ax' \times \left\{\frac{1}{2a} + \frac{x^2}{4a^3} + \frac{x^4}{16a^5} + \frac{5x^6}{256a^7} + \frac{5x^8}{1024a^9} + \frac{6x^{10}}{4096a^{11}} + \frac{23x^{12}}{65536a^{13}} + \&c.\right\}$$

the fluent of which is $x + \frac{x^3}{6a^2} + \frac{x^5}{40a^4} + \frac{5x^7}{896a^6} + \frac{5x^9}{4608a^8} + \frac{6x^{11}}{22528a^{10}} + \frac{23x^{13}}{425984a^{12}}$ &c. which, when $x = a$, will be $a \times \left\{1 + \frac{1}{6} + \frac{1}{40} + \frac{5}{896} + \frac{5}{4608} + \frac{6}{22528} + \frac{23}{425984} + \&c.\right\} = 119.87$ nearly, the whole length of the curve APC required.

By Mr. W. SETTLE, *Leeds.*

Put AB $= a$, AD $= x$, and PD $= y$; then, by sim. tri. $x : y :: a : \frac{ay}{x} =$ BC$' = \frac{\text{AP}}{2}$, and by the question $x^2 + y^2 = 4a^2y^2 \div x^2$. Therefore $y = x^2 \div \sqrt{(4a^2 - x^2)}$ is the equation of the curve.

QUADRATURE. The fluxion of the area is $yx' = x^2x' \div \sqrt{(4a^2 - x^2)}$, the fluent of which, by Vince's Fluxions, Art. 46, is found $= a\mathrm{A} - \frac{x}{2}\sqrt{(4a^2 - x^2)}$, where A is a circular arc, whose radius is $2a$ and sine x; and, when $x = a$, this becomes $= 1811.72 + =$ the area of the space ABC.

RECT. Now $y' = \frac{8a^2xx' - x^3x'}{\sqrt{(64a^6 - 48a^4x^2 + 12a^2x^4 - x^6)}}$; therefore $y'^2 + x'^2 = \left(\frac{64a^4x^2 - 16a^2x^4 + x^6}{64a^6 - 48a^4x^2 + 12a^2x^4 - x^6} + 1\right) \times x'^2 = \frac{64a^6 + 16a^4x^2 - 4a^2x^4}{64a^6 - 48a^4x^2 + 12a^2x^4 - x^6} \times x'^2$; hence $z' = \sqrt{\left(\frac{64a^6 + 16a^4x^2 - 4a^2x^4}{64a^6 + 48a^4x^2 + 12a^2x^4 - x^6}\right)} \times x'$. Then by expanding the quantity under the vinculum, we have $z' = x' \times : 1 + \frac{x^2}{2a^2} + \frac{x^4}{8a^4} + \frac{10x^6}{16^2.a^6} + \frac{10x^8}{32^2.a^8} + \frac{3x^{10}}{32^2.a^{10}} + \frac{46x^{12}}{256^2.a^{12}} + \frac{14x^{14}}{256^2.a^{14}} + \frac{50x^{16}}{1024^2.a^{16}} + \frac{65x^{18}}{2048^2.a^{18}}$ &c. $= x' + \frac{x^2x'}{2a^2} + \frac{x^4x'}{8a^4} + \frac{10x^6x'}{16^2.a^6} + \frac{10x^8x'}{32^2.a^8} + \frac{3x^{10}x'}{32^2.a^{10}} + \frac{46x^{12}x'}{256^2.a^{12}} + \frac{14x^{14}x'}{256^2.a^{14}} + \frac{50x^{16}x'}{1024^2.a^{16}} + \frac{65x^{18}x'}{2048^2.a^{18}}$ &c. Therefore $z = x + \frac{x^3}{3.2a^2} + \frac{x^5}{5.8.a^4} + \frac{10x^7}{7.16^2.a^6} + \frac{10x^9}{9.32^2.a^8} + \frac{3x^{11}}{11.32^2.a^{10}} + \frac{46x^{13}}{13.256^2.a^{12}} + \frac{14x^{15}}{15.256^2.a^{14}} + \frac{50x^{17}}{17.10242.^{16}} + \frac{65x^{19}}{19.2048^2.a^{18}}$ &c.; and, when $x = a = 100$, there results $100 + 16.6666666666 + 2.5 + .5580357142 + .1085069444 + .0265225497 + .0053992638 +$

.0014241536 + .0002804924 + .0000815642 = 119 .866917359, the required length of the curve.

This question was also answered by Messrs. Baines, Holt, and Godward.

(246) *By* Mr. Robert Smith, *Manchester.*

A and B shoot in their turns for a wager at pigeons flying. A finds that he can upon equality of chance kill three pigeons before B kills one; what are the odds in favour of A beating B at any assigned trial?

By the Proposer.

Solution. Let the odds be x to y in favour of A beating B at any assigned trial; then will $\frac{x}{x+y}$ be the probability of A winning, and $\left[\frac{x}{x+y}\right]^3$ the probability of his winning three trials successively, which by the question must be $\frac{1}{2}$. Therefore $2x^3 = (x+y)^3$, and $2\frac{1}{3}.x = x + y$, or $(2\frac{1}{3} - 1).x = y$: therefore $x : y$ :: $1 : 2\frac{1}{3} - 1 = .259 +$. Consequently the odds are 4 to 1 nearly, in favour of A beating B at any assigned trial.

Solutions were also received from Analyticus and Mr. Settle.

(247) *By* Mr. Isaac Samuels, *London.*

Old Jacob and his wife Joan have been in the constant habit of smoaking their pipes for the space of 50 rolling years, during which time they have always consumed four ounces of the Indian weed per week, which on the average cost them 2½d. per ounce. Now Jacob smoaked twice as many pipes as Joan, and one of his contained half as much more tobacco as one of hers. If the cost of this article had been put out weekly at compound interest, what would have been the amount in the 50 years, and how much Jacob's share of the expense?

By Mr. William Godward.

Here $\frac{5}{100} \div 52 = \frac{1}{1040}$, and $52 \times 50 = 2600$. Put 10d. $= a =$ weekly expenditure, and $b = 1 + \frac{1}{1040} = \frac{1041}{1040}$, then $a + ab + ab^2 + ab^3 + \ldots . ab^{2600} = a \times \frac{b^{2600} - 1}{b - 1} =$ £486 19*s*. 5¼*d*. = the amount; and ¾ of £483 19*s*. 5¼*d*. = £362 19*s*. 6¾*d*. Jacob's share of the expense.

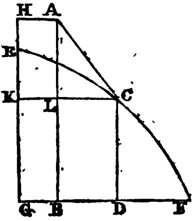
Remark.—I have taken the interest at the rate of 5 per cent.

Solutions were received from Messrs. Inexpertus, Hattersley, Settle, Jervis, and Analyticus.

(248) *By* Master C. Bartholomew.

The greatest and least heights of a writing desk above the horizon, are 50 and 38 inches, and the breadth of the leaf 20 inches. If a marble, by the force of gravity, roll down the whole length of the leaf, it is required to determine at what distance from the bottom of the desk it will strike the horizontal plane.

By Mr. William Godward.

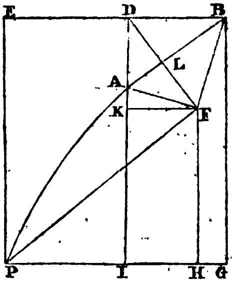


Let ABCD represent the writing desk, ECF a semi-parabola, EG its axis parallel to AB, cutting the directrix AH which is parallel to GF in H, and draw CK perpendicular to HG cutting AB in L; then AHKL is a right angled parallellogram. Put AB $= 50 = a$, CD $= 38 = b$, AC $= 20 = c$, AL $= a - b = 12 = d$, and LC $= (c^2 - d^2)^{\frac{1}{2}} = 16 = e$.

The absolute velocity in the curve at C : that in the direction EG :: $\sqrt{\text{HK}} : \sqrt{\text{EK}}$ :: AC : AL. (Emerson's Mechanics, Prop. 15.) Hence, EK = HK × AL² ÷ AC² $= d^3 \div c^2$, and EH = KH − EK $= d$

$- d^3 \div c^2 = (c^2 - d^2)d \div c^2 = e^2d \div c^2$. Also, by the parabola, $\text{KC} = \sqrt{\text{EK}\,.\,4\text{EH}} = 2ed^2 \div c^2$, $\text{EG} = \text{EK} + \text{KG} = d^3 \div c^2 + b$, and $\text{GF} = \sqrt{\text{EG}\,.\,4\text{EH}} = \frac{2e}{c}\sqrt{(d^4 \div c^2 + bd)}$, lastly $\text{DF} = \text{GF} - \text{KC} = \frac{2e}{c}\sqrt{(d^4 \div c^2 + bd)} - 2ed^2 \div c^2 = 24.53648$ the distance required.

By the Proposer.



Const. Take DI = 50, and AI = 38; through D, I draw the indefinite perpendiculars EDB, PIG; from A to EB apply AB = 20; draw DL perpendicular to AB, in which produced take FL = DL; then from F to PG apply FP = DI, and PI will be the distance required.

Dem. Draw PE perpendicular to BE, and join AF. Since DL = FL, and AL is common to the right angled triangles ALD, ALF, therefore AD = AF; and because (by const.) PF = DI = PE, the points A, P are in a parabola, whose focus is F, and directrix EB; or PI = the distance sought.

Calc. Draw FK parallel to PG, cutting DI in K. Now, by right-angled triangles, $\text{DL} = \frac{\text{DB} \times \text{AD}}{\text{AB}} = \frac{12 \times \sqrt{(20^2 - 12^2)}}{20} = \frac{48}{5}$. Therefore $\text{DF} = \frac{96}{5}$. And, by similar triangles, AB : DB :: DF : DK $= \frac{584}{25}$. Therefore $\text{IK} = \frac{866}{25} = \text{FH}$: Whence $\text{PH} = \sqrt{(\text{PF}^2 - \text{FH}^2)} = 36.056$. But AB : AD :: DF : FK = IH = 11.520, which subtracted from PH leaves PI = 24.536 inches. W.W.R.

Ingenious solutions to this question were also received from Messrs, Godward, Settle, Jervis, and Analyticus.

(249) *By* Mr. JOHN BAYNES, *Doncaster.*

Find the sum of the infinite series $\frac{1}{1.2.4} + \frac{4}{2.3.5} + \frac{7}{3.4.6} +$ *&c.* by the method of Increments.

By the Proposer.

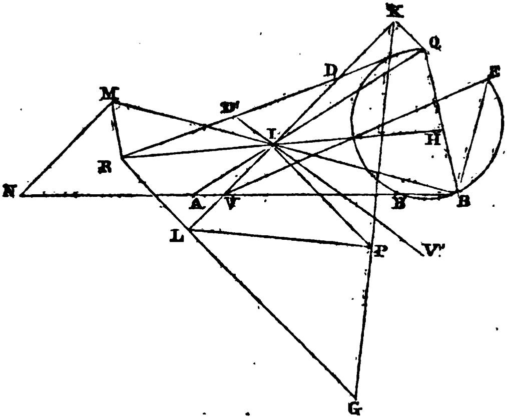
Here the general term is $\frac{3x-2}{x.(x+1).(x+3)}$, which, by multiplying both sides of the fraction by $x+2$, becomes $\frac{(x+2).(3x-2)}{x.(x+1).(x+2).(x+3)} = \frac{3x^2+4x-4}{x^{4|1}}$ $= \frac{3x}{(x+1)^{3|1}} + \frac{4}{(x+1)^{3|1}} - \frac{4}{x^{4|1}}$. Put $x+1=z$, then $3x = 3z-3$, and $\frac{3x}{(x+1)^{3|1}} = \frac{3z-3}{z^{3|1}} = \frac{3}{(z+1)^{2|1}} - \frac{3}{z^{3|1}}$, which by restoring the value of z gives $\frac{3}{(x+2)^{2|1}} - \frac{3}{(x+1)^{3|1}}$; consequently $\frac{3x^2+4x-4}{x^{4|1}} = \frac{3}{(x+2)^{2|1}} + \frac{1}{(x+1)^{3|1}} - \frac{4}{x^{4|1}}$, the integrals of which are $\frac{3}{x+2} + \frac{1}{2(x+1)^{2|1}} - \frac{4}{3(x)^{3|1}} = 1 + \frac{1}{12} - \frac{2}{9} = \frac{31}{36}$; where $x = 1$, its first value. Therefore $\frac{31}{36} =$ the sum of the infinite series.

Ingenious solutions have been received from Analyticus and Mr. Wm. Settle.

(250) *Prize Question, by* Mr. J. H. SWALE, *Liverpool.*

The points Q,R, and the parallels MN,VI are given in position, to draw the parallels QB, RM meeting VB, MN in B, M, so that, joining B, M cutting VI (the other line given in position,) in L the segment IV shall be a maximum or minimum.

By the Proposer.



1. We will suppose IV to be equal a given line; in which case, we shall have to draw the parallels QB, RM so, that BM may pass through a given point I: to which problem we have this easy and elegant

COMP. Draw RI, QI, VE, making $\angle$ BVE $=$ $\angle$ HIQ, and QI : VE $=$ RI : NV; producing QI to NV at A: a circle through Q, E, to contain the difference of the angles QAB, QIH, determines B, and thence the whole.

Draw EB, QB, the latter meeting RI at H; also BI meeting NM at M, and join R, M.

By Comp., $\angle$ EBV $-$ $\angle$ QBA $=$ $\angle$ QAB $-$ $\angle$ QIH $=$ $\angle$ QAB $-$ EVB; and therefore $\angle$ EBV $+$ $\angle$ EVB $=$ $\angle$ QAB $+$ $\angle$ QBA, or $\angle$ BEV $=$ $\angle$ BQA. Hence, as $\angle$ EVB $=$ $\angle$ QIH by comp., we shall have $\angle$ EBV $=$ $\angle$ QHI; that is, the $\angle$s BEV, HQI are mutually equiangular, having QI : VE $=$ IH : VB $=$ RI : NV per the comp.; *et alternando*, HI : IR $=$ BV : VN $=$ BI : IM, because of the parallels VI, NM.

∴ Consequently, QB, RM are parallel, and BM passes through I

2. When IV is to be a maximum,

Draw QK, RL perpendicular to IV; and also QR meeting IV at D.

In RL take $LG^2 : LK^2 = RD : DQ$; join G, K; draw LP, PI perpendicular to KG, KL; then, by the preceding case, draw the parallels QB, RM so, that BM shall pass through I, and it is done.

Draw QI, RI; then, since QB, MR are parallel, and BM passes through I, it only remains to prove IV a maximum.

Because of parallels, $KI^2 : IP^2 = KL^2 : LG^2 = QD : DR$ by the comp., or $QD . IP^2 = DR . IK^2$; also, since LP is perpendicular to KG, it follows, that LP or LP^2, or $LI^2 + IP^2$, or $QD . LI^2 + QD . IP^2 = QD . LI^2 + DR . IK^2$, equal a minimum. That is, $QD . LI^2 + QD . LR^2 + DR . IK^2 + DR . KQ^2 = QD . RI^2 + DR . QI^2$, equal a minimum. Now, per a known property of triangles, $QR . DI^2 + QR . QD . DR = QD . RI^2 + DR . QI^2$, or $QR . DI^2 + QR . QD . DR$ equal a minimum; and as QR is a given line, it follows, that $DI^2 + QD . DR$ is a minimum. Consequently, QD . DR being a given rectangle, DI^2 or DI is a minimum.

Hence, VD being a given line, IV is obviously the greatest, or a maximum.

The parallelism of the lines MN, IV is not essential in the foregoing comp.; for VID may have any position whatever, as V′ID′: it will only remain to determine the point I for a given line or for a maximum, as in the preceding cases; and draw IV parallel to MN. The rest will be as before.

3. The minimum value of VI or V′I, appears to obtain when the parallels BQ, MR are drawn, making BM pass through V or V′.

The comp. will not be materially different when QB, RM, instead of being parallel to each other, are to include a given angle.

Solutions to this question were also received from Mr. Settle, Analyticus, and AB.

THE

LEEDS CORRESPONDENT,

A

Literary, Mathematical, and Philosophical Miscellany.

> Tarda fluunt ingrataque tempora, quæ spem
> Consiliumque morantur agendi gnaviter id, quod
> Æque pauperibus prodest, locupletibus æque;
> Æque neglectum pueris senibusque nocebit.
>
> HORAT.

No. III. JULY, 1822. VOL. IV.

REVIEW.

The Life of WILLIAM HEY, ESQ., F. R. S., *Member of the Royal College of Surgeons, in London; Honorary Member of the Royal College of Surgeons in Ireland; of the Royal Medical Society of Edinburgh; and of the Literary and Philosophical Society of Manchester; and late Senior Surgeon of the General Infirmary of Leeds.*—By JOHN PEARSON, F. R. S. F. L. S. M. R. I. *Member of the Royal College of Surgeons in London, &c. &c.* LONDON, 8vo. pp. 667.

(Continued from page 110.)

PREVIOUSLY to fixing his residence at Leeds, his former master, Mr. Dawson, had offered to receive him as a partner: but, after much deliberation, this proposal was declined, chiefly from deference to the opinions of his parents. The kind intentions of Mr. Dawson did not, however, terminate here; he expressed a desire that Mr. Hey should reside near him, promising to send to him as many of his surgical patients as would receive his recommendation.

From the time in which Mr. Hey first engaged in practice, he treated the most serious accidents, and performed all the chirurgical operations which were necessary, never declining any cases which presented themselves on account of their difficulty, or danger: and on such occasions, his seniors in Leeds very kindly lent him their countenance and assistance. Mr. Hey, his son, believes, that his father performed the operation of lithotomy, successfully, three times, in his private practice within the first year.

During the first years in which Mr. Hey exercised his profession, his progress in gaining business was slow, his range of practice was narrowly circumscribed; and it appears, that nearly ten years elapsed before the regular emoluments of his practice were equal to the expenses of his family. He and his friends were little disposed, at that time, to anticipate the reputation he afterwards acquired, and the long career of successful exertion which was allotted to him. A large proportion of those who engage in the medical profession, must be prepared to contend with difficulties, to encounter a variety of impediments, and to undergo the severe discipline of mortification and diappointment, on their first entering into business. The talents and skill of a surgeon cannot be known immediately on his announcing himself a candidate for confidence and employment. He must wait on the slow operation of time, and on the intervention of circumstances favourable to the disclosing of his professional abilities. It must be however, a very peculiar concurrence of adverse events, which can finally obstruct the success of persevering diligence, and competent professional acquirements. It was not a prejudice against youth and inexperience which constituted the most serious obstacle to Mr. Hey's early success in business; his religious character and connections operated powerfully against him, and the lustre of his superior attainments was too feeble to penetrate the dense medium with which prejudice, during a long course of time, enveloped the minds of his townsmen. That some other causes conspired to exclude him from general acceptance, will be readily granted. Mr. Hey had the habits and feelings of a gentleman, and was in little danger of offending against the common rules of civility and good breeding;

yet it must be allowed, that, in some of the earlier years of his life, he was remarkably grave, reserved, and silent; his manner was calculated rather to inspire reverence, than to conciliate regard, and the features of his virtue appeared austere and unbending. There is a certain amenity of manners and grace of deportment, which are calculated to exert a prepossessing influence in the intercourse of men with each other, and to facilitate as well as to enlarge the natural impulsive agency of the social spirit in the ordinary commerce and occurrences of life. That these have no necessary connection with talents, virtue, or acquirements, requires no formal proof; but it is not less true, that all the substantial parts of benevolence, kindness and humanity, may exist in full vigour and operation, where the more obvious and engaging qualities are obscurely exhibited. It is beyond dispute the duty of every man to be unblamable, upright, and good, and it is his interest, as well as his duty, to be courteous and agreeable; defects in the former are culpable deviations from the essentials of morality; failures in the latter partake of the nature of physical imperfections, which a discerning candour, while it disallows, can forgive.

On the 30th of July, 1761, Mr. Hey married Miss Alice Banks, the second of four daughters of Mr. Robert Banks, a gentleman of Craven, in Yorkshire. Some acquaintance had been formed with the young lady, during Mr. Hey's residence with Mr. Dawson; but he had entertained no serious thoughts of making her an offer of marriage, till after his return from London. In the course of his visits, Mr. Hey deemed it his duty to represent to Miss Alice Banks, the obligations, the cares, the solicitudes, with which the married state is connected, that her mind might be duly prepared for the serious and important duties of domestic life, and not be hastily engaged in an undertaking, the nature of which she had not well considered. Whatever may be thought of this mode of addressing the object of his attachment, its integrity must be approved by all; nothing was more remote from his character and principles, than, by flattering pretensions, by partial and unreal representations, to allure the woman, who was to be his companion for life, to contract an irrevocable engagement under delusive impressions. The good sense of Miss Alice Banks enabled her to form a correct estimate of the character of her admirer; she was convinced that Mr. Hey was a man with whom she might safely entrust her person and her happiness, nor had she ever occasion to regret the confidence she reposed in him.

Mr. Hey was, during one year, from the month of February, 1762, to February, 1763, the medical attendant on the Leeds Workhouse; for no public institution, appropriated to the relief of the sick and hurt, existed then in that town. The first meeting which was called for the purpose of establishing an infirmary in that populous place, was on May 20th, 1767, about six years after Mr Hey had commenced business. It was then agreed, that a *parochial* Infirmary should be established. The contributions for this object being larger than was expected, it was resolved, at a subsequent meeting, held the 19th of June that the Infirmary should be *general*. A house was taken on the 25th of July, as a temporary Infirmary, until a building suitable to the purpose could be erected; and the rules for conducting the establishment were read and confirmed the 29th of July; the medical officers of the charity were also appointed at the same meeting.

It is highly probable, that the first motion towards the founding of an Infirmary originated with Mr. Hey; this is, however, a matter of inferior importance, since it is quite certain that he engaged more actively in the establishing of it than any other individual, his name appearing in the records of almost all the meetings and committees, for building, forming the laws, &c.; indeed, he was the only medical man who was placed on the building Committee.* On the first of July, 1768, he received a vote of thanks from the Quarterly Board, "For the trouble he has taken in relation to the building, and that he be reimbursed the expenses he has been, or shall be at, concerning the same." The patients were removed from the temporary house, to the new Infirmary, about March 1, 1771. Since the first erection of the Leeds Infirmary, the building has been enlarged at three different times, by the addition of two wings, and a third story. It now contains one hundred and sixteen beds.

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* It may, perhaps, be regarded as a singular occurrence, that Mr. Hey, who was among the first contributors to the Infirmary, was also the survivor of all the contributors whose names are inserted in the First Report.

In the year 1768, Mr. Hey, in conjunction with the principal medical men of the town, formed a medical society, which met once a month, for the discussion of professional subjects, and the purchase of medical books. A subject connected with medicine, or surgery, was proposed by each member in his turn, which was discussed at the subsequent meeting; the proposer of the subject being chairman for the evening. I find a regular account of these meetings from June, 1768, to October, 1769; but whether they continued longer I know not. This society, however, laid the foundation of a good medical library, which is the property of the Infirmary, and is still increasing. The medical society subsists in name, but meets only for the purchasing of books, and the management of the library.

It was about the year 1768 or 1769, that a very friendly intercourse commenced between Mr. Hey, and the late Dr. Priestley, who then resided at Leeds; and their intimacy was maintained during several years by an epistolary correspondence, after Dr. Priestley retired from Leeds. Mr. Hey being acquainted with the Chemistry of that period, Dr. Priestley conferred much with him on the subject of the various pursuits in which he was engaged, and always imparted to him the several discoveries he made in the properties of the gaseous fluids, to which his attention was at that time principally directed. Dr. Priestley in his History of vision, light, and colours, published in 1772, when treating on the immediate seat of vision, had been strongly inclined to regard the choroid coat of the eye, as the part which excited the perception of visible objects; but, it appears in the additions subjoined to that work, that he was induced to doubt of the correctness of this opinion, perhaps to change it, in consequence of the facts and arguments suggested to him by Mr. Hey.

To verify the opinion of the antiseptic qualities, which were supposed to reside in fixed air, (carbonic acid gas,) as appeared from experiments made by Dr. Priestley, on dead animal matter, Mr. Hey determined to employ it as an enema, in cases of putrid fever, where the alvine discharges were acrid and offensive. A convenient apparatus for distending the bowels with this gas was easily contrived and in some cases the patients seemed to derive considerable comfort and benefit from using it. This mode of administering it, however, was never introduced into general practice. He likewise made use of this gas, by applying it to the surface of cancerous ulcers; but not with such manifest advantage as to induce him to persevere for any considerable time in this mode of treatment. In the year 1772, Dr. Priestley was present at some experiments made by Mr. Hey on the blood, in which the results were directly at variance with some published by Mr. Hewson: the Doctor was satisfied with the correctness of those made by Mr. Hey, who was encouraged to publish them, in 1779, in his "Observations on the Blood." The high opinion in which Dr. Priestley held the talents and acquirements of Mr. Hey, both as a professional man and a philosopher, induced him to propose this gentleman as a proper person to be admitted into the Royal Society. He was elected a fellow in the year 1775, and in a letter to Mr. Hey from Dr. Priestley communicating the intelligence of that honourable distinction, he writes, "I wish I could say, that one of the members in ten, had equal pretensions to it." *

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* "The only person in Leeds who gave much attention to my experiments was Mr. Hey, a surgeon. He was a zealous Methodist, and wrote answers to some of my theological tracts; but we always conversed with the greatest freedom on

The friendship long cherished by those two philosophic men will be thought highly creditable to the candour and liberality of their minds, when the circumstances, under which it was contracted and nurtured, are made known. Dr. Priestley was, at that period, a confirmed Dissenter, a Socinian, and not friendly to the established government of this kingdom. Mr. Hey was steadily attached to the Church of England, by affection and principle; his religious tenets were strictly consonant with the Articles, homilies, and liturgy of the Established Church; and he was a warm and unvarying advocate for the constitution in church and state. Dr. Priestley, who was zealous in propagating his peculiar religious opinions, to effect his purpose more certainly and extensively, printed and distributed little tracts, without his name, on the most important doctrines of Christianity, written with a plainness and simplicity which were calculated to engage the attention of the middle and lower classes of the population. Mr. Hey was deeply impressed with a persuasion of the great importance of those doctrines to the eternal interests of mankind, which his friend was controverting and labouring to overthrow. Being dissatisfied with the replies which were published, and having given much attention to the subjects in debate, he wrote a small tract, in "Defence of the Divinity of Christ," and a second, as a "Short Defence of the Doctrine of the Atonement." Dr. John Hey, Norrisian Professor of Divinity in the University of Cambridge, was accustomed to notice this tract on "the divinity of Christ," in his public lectures in Divinity.

Another gentleman, (a clergyman nearly connected with Mr. Hey's family,) proceeds to remark on Mr. Hey's friendly intercourse with Dr. Priestley: "How far this intimacy may be justified, and whether Mr. Hey, in the

philosophical subjects, without mentioning any thing relating to theology. When I left Leeds, he begged of me the earthen trough in which I had made all my experiments while I was there."

MEMOIRS *of Dr. Joseph Priestley*, &c. Page 63.

later periods of his life, would have formed it, is a question on which his friends may possibly differ." Whatever difference in opinion, on this subject, may have existed among the friends of Mr. Hey, or may still exist, a doubt may be suggested, whether it be a question on which it is, at this time, absolutely necessary to decide. When nothing is determined, explicitly, by laws divine or human, the decision of the casuist may be an undertaking of great delicacy and difficulty. Where the reality of the fact asserted is sufficiently attested, it is necessary to be acquainted with the several circumstances connected with the dubious action, with the motives of the party concerned, and with the confirmed, habitual principles by which his general conduct in life is regulated. When these requisites have been duly adjusted, modesty and charity, twin virtues, may be admitted to a hearing, and they will probably suggest, that it is always wise and safe to suspend our judgment, where there is danger of concluding erroneously, and to leave doubtful cases to the sentence of that Omniscient Being, who may have reserved them for his own tribunal.

In the year 1773, Mr. Hey received an injury in his knee, by striking it against the stone work of a cold bath as he was ascending out of the water. The effects of this accident were aggravated soon afterwards by his horse falling with him. This second injury obliged him to submit to a quiescent state during some weeks; and, on resuming his accustomed exercise, he never regained his original power of walking, but was more or less sensible of a diminution of strength and capacity of enduring fatigue in that limb. These injuries laid the foundation of a lameness which continued during the remaining years of his life. Mr. Hey recovered, however, from the effects of these accidents, so as to be able to pursue his professional duties in the town of Leeds, without any perceptible inconvenience, and he visited his patients on horseback in all the villages around him, by day, or by night, with as great diligence and attention as formerly.

Early in the year 1778 he received a stroke upon the thigh of the weak limb from his horse, in mounting, which, for a time, threatened to suspend his future professional exertions. At this period he was fully engaged in business; his reputation stood high as an operating surgeon; persons came from remote parts of Yorkshire to Leeds, that they might be under his immediate care; and he was frequently called to considerable distances from Leeds in cases of difficulty and danger.

Mr. Hey had now a large family, and was soon to be the parent of an eleventh child; his rising fame presented before him a reasonable prospect of distinction and emolument, as creditable to himself as advantageous to his family. Amidst the full tide of this honour and prosperity, he was disabled from using all active exertions; the remedies which were employed by his own direction, or by the suggestions of his professional friends, were of little benefit to him; and it appeared probable to himself, and to those who were qualified to judge of his case, that he would never regain the power of walking. Mr. Hey felt this afflictive dispensation of the Divine Providence as every considerate man, in similar circumstances, would feel it; he was deeply affected by it, but betrayed no murmuring nor discontent, no impatience, nor unmanly dejection of mind. His religious principles were now tried, and he was enabled to sustain this visitation with humble submission, and a meek acquiescence in the divine will, relying with an unsuspecting confidence upon the gracious declarations of his heavenly Father.

In a conversation with an intimate friend, who was lamenting the apparent consequences of a disorder which menaced the extinction of his prospects of future usefulness, he said, "If it be the will of God that I should be confined to my sofa, and He command me to pick straws during the remainder of my life, I hope I should feel no repugnance to His good pleasure." This was not only the language of true wisdom, it was the spontaneous effusion of that divine philosophy in which Mr. Hey had been instructed by the Sacred Scriptures, and was an effect wrought by the supernatural influence of heavenly grace. The patience of a Christian bears little resemblance to the affected magnanimity of a Stoic, or the frigid indifference of a Pyrrhonist. True religion infuses a nobleness of character, an elevation of mind, a magnanimity of soul, which break forth under the strokes, the trials, the reverses, and multiplied sorrows to which we are exposed, and sustain the spirit of the man in serenity and composure, amidst the agitations of every conflicting and varied form of adversity. The will of God is a centre upon which the soul can securely and peaceably rest, and find not only repose, but even content and satisfaction, when the atmosphere of this fluctuating world is most clouded and tempestuous. A manly submission to events, which no human power nor wisdom can control, merits respect, and commands admiration; yet it must be regarded as an excellence of a higher order, when, with these human virtues, we witness the absence of all perturbation, and anxious solicitude, a cheerful resignation to the appointments of infinite wisdom, with a sincere and uniform desire that the supreme will may be fulfilled, whatever be the issue of the present dispensation.

Mr. Hey's recovery from lameness appearing remote and uncertain, he went to London in the spring of 1778, and consulted some of the most eminent surgeons in the metropolis. By their advice he proceeded to Bath, where he remained a considerable time; and, during his stay there, he commenced an acquaintance with Sir John Pringle, Bart., P. R. S. He likewise renewed his friendship with Mr. Arden, who had been a teacher at Heath Academy, and was now engaged in giving a course of philosophical lectures at Bath. Mr. Hey having offered to dissect an eye for Mr. Arden's Lecture on Optics, he was requested by the lecturer to demonstrate the organ of vision to the audience, and with that request he readily complied. He went from Bath to Harwich for the benefit of sea-bathing, and returned to Leeds, after an absence of four months, in good health, but little improved in his capacity of using the injured limb. From this period to that of his death, he was never able to walk, except across a room of ordinary size, without the aid of a crutch; he could not bear the fatigue of standing longer than a few minutes; and although he recovered so far, at one period, as to walk the length of a short street with his crutch, yet, in consequence of exerting himself too freely, he relapsed into his former state of lameness. He rode about the town of Leeds, occasionally, on horseback, and sometimes to the distance of a mile beyond it; but he was obliged to pay the greater part of his professional visits in a carriage. Mr. Hey, on leaving Leeds, committed the care of his business to a young man who had resided with him as a pupil for some time; the surgeons of the Infirmary took upon themselves his duty in that Institution; and both they and the Physicians kindly gave their assistance, when requested, in any case of difficulty and danger that occurred among his private patients. On his return to Leeds, he did not find his professional employments remarkably diminished; his business soon began to increase rapidly, and his ability to fulfil the numerous calls that pressed upon him was materially facilitated by the use of a carriage. It was with great reluctance that Mr. Hey acquiesced in keeping a carriage, but it was a measure forced upon him by the necessity of his condition, and he had no reason, ultimately, to regret this additional expense, since it contributed to diminish the fatigues of his increasing business, and was, probably, under the Divine Providence, one great means of protecting his health, enlarging his sphere of usefulness, and of protracting a life valuable to his family and to the whole community. Man is a very incompetent judge of what is best for him in the course of human affairs; for events, apparently the most unpropitious and menacing, are not unfrequently made subservient to his future prosperity and happiness.

In the year 1783 a Philosophical and Literary Society was formed in Leeds, of which it appears (by a letter addressed to him in that capacity) that Mr. Hey was the President. Whether this distinction was assigned to him permanently or whether a new President was elected annually, cannot now be ascertained. The duration of this Society was probably of no long continuance, since the existing records of its meetings do not descend below the year 1786. The Society was sometimes favoured in its sittings by the presence and assistance of Mr. Smeaton, the engineer; but it is uncertain whether he was a regular member, or only an occasional visitant.

Mr. Hey was elected a Member of the Literary and Philosophical Society of Manchester, December 14, 1785.

He was elected an Honorary Member of the Royal Medical Society of Edinburgh, on the 21st of February, 1789.

Mr. Hey resigned his office of Surgeon of the Leeds Infirmary, October 7, 1812, having just completed his seventy-sixth year. He had been Surgeon of that Institution somewhat more than forty-five years, during thirty-nine of which he was the Senior Surgeon. His son, the present Mr. Hey, was unanimously elected to the office vacated by the resignation of his father, on the following day. This gentleman has been long treading in the footsteps of his revered predecessor; and, by his ability, assiduity, and integrity, supplies, as far as those can supply, the loss which the public has sustained by the death of his Father.

By the resignation of Mr. Hey, his official connexion with the Infirmary ceased; but he was requested by the medical officers to attend the chirurgical operations there, whenever it might be agreeable to him; and he frequently availed himself of this obliging invitation. He shewed a lively interest in every matter which affected the welfare of the Institution; and, on the discussion of any measure of importance, his opinion had always great weight with the Trustees.

The long, active, and useful life of Mr. Hey was now approaching to its termination. He had generally enjoyed good health, and had not been confined by any serious indisposition till the year 1808, when, on his return from

London, he suffered from a disorder of the bowels, which reduced him to a state of great weakness, and many months elapsed before he was in a capacity of resuming his professional labours. In December, 1816, he sustained another most alarming attack of a very painful and dangerous disease in his bowels. He suspected that ulceration had taken place in the colon, or its transverse arch. It pleased God, however, to restore him to his friends and to the public, after a confinement of more than three months; and, although his strength, in his own conception, was not remarkably impaired, nor his vigour abated, yet he never recovered perfectly from the injury inflicted on his constitution by that long and severe indisposition. He was, indeed, capable of going through his professional duties without much inconvenience, yet he was not without uneasy and uncomfortable feelings, occasionally in the abdomen. He would sometimes say; "I am sure all is not right in my bowels;" and some months after his illness, alluding to the uneasiness in the lower part of his body, he said; "I have that about me which will carry me to my grave." His prognostic was too correctly verified in little more than a year afterwards. Few men, at the advanced period of eighty-two years, had suffered less from the pressure of age and its usual infirmities, either in their corporal or intellectual powers, than Mr. Hey: hence he would often remark, that he was obliged to bring in the aid of reason to tell him that he was an old man, since he experienced nothing of those symptoms of decrepitude, which, at the age of eighty years, in the emphatical language of Solomon, render *the grasshopper a burthen.* He would add, "I can now enjoy all the innocent pleasures of life, as much as I ever could." His eye-sight was remarkably good, for he could read and write in a good light, without spectacles; and his hand-writing was firm and distinct, without any of those inequalities which indicate a tremulous pen. His hearing was acute; and his vocal powers, although much diminished, were yet very agreeable, and indicated that he could once have sung well. Of the change in his mental powers he chiefly complained of the imperfection of his memory; but the distinctness of his conceptions, the soundness of his judgment, his orderly and correct mode of thinking, and his facility of conveying his notions with perspicuity, copiousness and fluency, do not appear to have suffered any remarkable diminution. He moved with much alertness and agility, and appeared to retain considerable power of exertion; and, in a conversation upon old age, about six months before his death, he remarked, that the Psalmist had said, *The days of our years are threescore years and ten; and if, by reason of strength, they be fourscore years, yet is their strength labour and sorrow;* but, added he, with a smile, "I have not yet found them either labour or sorrow." In a long conversation with which the writer of this Memoir was indulged by Mr. Hey, about six months before his death, upon a subject which had required much patient research, Mr. Hey displayed a wonderful promptitude and vivacity, and evinced as much logical precision and metaphysical acumen, as at any period of his life. Much of the freshness and vigour which Mr. Hey retained in his declining years, and which rendered his old age pleasant and useful, may be ascribed, under the blessing of Divine Providence, to his early rising; his strict habits of temperance; the equanimity of his temper; and to that internal peace, composure, and serenity, which are the concomitants of a holy and devout life. There is scarcely any thing more repugnant to experience than a healthful body in advanced years, a calm, tranquil, and vigorous mind, when little or no discipline has been exercised, early, over the appetites and passions; where all the pursuits have been animal and secular, and where indulgence has been allowed and justified in every instance not marked as degrading and scandalous by the verdict of the world. But inconsistent expectations have been always cherished, and the disappointments confuting these expectations, have not always taught the sufferers the folly of indulging hopes which experience has uniformly falsified, and which are as contrary to good sense as to the laws of the divine government. Although prudence and temperance, conducted by wisdom and animated by Christian piety, do not assure health and long life to the possessor, yet they conduce to both, and they tend to infuse that cheerfulness and serenity, without which life itself would be scarcely desirable. Perfection and happiness, unchanging and never-ending, are proposed as excitements and rewards every way suited to the wants and desires of immortal creatures; and, according to the measure we attain of these superior blessings, whilst fulfilling our duty on earth, we participate of the enjoyments of heaven.

On the 7th, 8th, and 9th of March, 1819, Mr. Hey had been obliged to visit patients at the distances of ten and twelve miles from his house, in addition to the regular business of the day; and, in consequence of his close engagements, he had given less attention to the state of his bowels than was customary with him. On Tuesday, the 9th, when returning home in the evening, he felt rather cold and chilly, which surprized him, since he had remarked, whilst on his journey, that the day was warmer than some of the preceding days. He retired to bed, however, apparently well. He awoke about five o'clock in the morning of the 10th, with a shivering, which was very soon followed by pain in the bowels, not severe, but accompanied with frequent vomiting; his tongue was furred, his pulse languid, and not very frequent. On Wednesday night, or early on Thursday morning, his bowels were relieved copiously; his stomach was quieted; the pain diminished; and he felt much better. On Friday and Saturday he continued to improve, but had some hiccough. On Sunday he was free from pain, except when the hiccough came on, and this was generally excited by any exertion. On Monday morning, his son, Mr. William Hey, considered him out of danger, and thought that nothing was wanting but the recovery of his strength. Mr. Hey was now able to sit up in bed, and to employ himself a little in reading. On Tuesday, the 16th, he was not so well; his tongue, which was becoming moist and clean, became again dry and furred; his pulse was more frequent, and all his symptoms wore a more unfavourable aspect.

Wednesday, Thursday, and Friday, his disease was gaining upon him gradually; his tongue was covered with a black crust; his mouth was exceedingly dry and parched, and he said that 'his tongue felt like a piece of dry board.' His strength was so much reduced, that he was unable to converse much with his attendants. The plan of treatment now adopted was calculated to support his strength, and restrain his diarrhœa. The symptoms enumerated above continued, with little variation, till Tuesday, the 23d of March; in the evening of which day, about six o'clock, he expired.

Towards the latter part of his illness, his mind wandered occasionally; but this was, apparently, rather the effect of debility than from the accession of delirium, since he could, generally, if not always, return a rational answer to the questions proposed to him.

Mr. Hey was buried at St. Paul's Church, on Saturday, March 29; his funeral was attended by a great number of his friends and fellow-townsmen; and a funeral sermon was preached on the following day, Sunday, by his friend and highly respected pastor the Rev. Miles Jackson, in the Church of St. Paul, where Mr. Hey had been a constant attendant on divine worship, since its consecration in 1793. The congregation was unusually large, and a great part of them were in mourning. Mr. Jackson preached from the 5th chapter of Genesis, verse 24; *Enoch walked with God, and he was not; for God took him.* A more appropriate text could scarcely have been chosen for this solemn occasion.

Having now brought Mr. Hey's professional Life to a close, we will, if our limits permit, in our next number, give some extracts from the Moral and Social Life, and conclude this long article with a few strictures on some of the statements and arguments.

READY MONEY JACK.

A NEW work, entituled BRACEBRIDGE HALL, containing entertaining sketches of the most prominent individuals in a secluded village in Yorkshire, has just made its appearance; and from it we have extracted this sketch of *Ready-money Jack,* and the one of *The Schoolmaster,* which follows,—not because they are the best characters in the book, but because they form a curious contrast, which every one who has visited the less-frequented districts of England cannot fail occasionally to have observed.—BRACEBRIDGE HALL is the production of Washington Irving, Esq., an American Gentleman, who, under the assumed name of GEOFFREY CRAYON, has acquired, both in this country and in his own, a well-merited reputation by his very interesting *Sketch Book,* and other literary performances. We are sorry that he has had the misfortune to visit England at a period when the degrading style of the Turf and the Ring, and of the *Tom and Jerry* fooleries, has extended itself even among those of our cotemporaries who wish to be accounted polite writers. We wait with some impatience for that natural re-action, which it has been a part of our felicity to witness in many other popular yet momentary delusions of style. From these glaring defects the celebrated Author of *Waverley* and *The Fortunes of Nigel* is, of all the attendants at the court of Imagination, most conspicuously free: We should have rejoiced to behold an equal degree of freedom from this temporary mania in Mr. Irving; but as the traces of the style, here reprobated, are not the prevailing features of the work, we shall conclude this introduction by observing, that the characters introduced into *Bracebridge Hall,* though not *in every point* true to nature, are evidently from the pen of a cultivated mind and of an attentive observer.

ON the skirts of the neighbouring village there lives a kind of small potentate, who, for aught I know, is a representative of one of the most ancient legitimate lines of the present day; for the empire over which he reigns has belonged to his family time out of mind. His territories comprise a considerable number of good fat acres; and his seat of power is in an old farm-house, where he enjoys, unmolested, the stout oaken chair of his ancestors. The personage to whom I allude is a sturdy old yeoman of the name of John Tibbetts, or rather "Ready-money Jack Tibbetts," as he is called throughout the neighbourhood.

The first place where he attracted my attention was in the church-yard on Sunday; where he sat on a tombstone after the service, with his hat a little on one side, holding forth to a small circle of auditors; and, as I presumed, expounding the law and the prophets; until, on drawing a little nearer, I found he was only expatiating on the merits of a brown horse. He presented so faithful a picture of a substantial English yeoman, such as he is often described in books, heightened, indeed, by some little finery, peculiar to himself, that I could not but take note of his whole appearance.

He was between fifty and sixty, of a strong, muscular frame, and at least six feet high, with a physiognomy as grave as a lion's, and set off with short, curling, iron-gray locks. His shirt collar was turned down, and displayed a neck covered with the same short, curling, gray-hair; and he wore a coloured silk neck-cloth, tied very loosely, and tucked in at the bosom, with a green paste brooch on the knot. His coat was of dark green cloth, with silver buttons, on each of which was engraved a stag with his own name John Tibbetts, underneath. He had an inner waistcoat of figured chintz, between which and his coat was another of scarlet cloth, unbuttoned. His breeches were also left unbuttoned at the knees, not from any slovenliness, but to shew a broad pair of scarlet garters. His stockings were blue, with white clocks,; he wore large silver shoe-buckles; a broad paste buckle in his hat-band; his sleeve buttons were gold seven-shilling pieces; and he had two or three guineas hanging as ornaments to his watchchain.

On making some inquiries about him, I gathered, that he was descended from a line of farmers that had always lived on the same spot, and owned the same property; and that half of the church-yard was taken up with the tombstones of his race. He has all his life been an important character in the place. When a youngster, he was one of the most roaring blades of the neighbourhood. No one could match him at wrestling, pitching the bar, cudgel play, and other athletic exercises, Like the renowned Pinner of Wakefield, he was the village champion; carried off the prize at all the fairs; and threw his gauntlet at the country round. Even to this day the old people talk of his prowess, and undervalue, in comparison, all heroes of the green that have succeeded him; nay, they say, that if Ready-money Jack were to take the field even now, there is no one could stand before him.

When Jack's father died, the neighbours shook their heads, and predicted that *young hopeful* would soon make way with the old home-stead; but Jack falsified all their predictions. The moment he succeeded to the paternal farm, he assumed a new character; took a wife; attended resolutely to his affairs, and became an industrious, thrifty farmer. With the family property he inherited a set of old family maxims, to which he steadily adhered. He saw to every thing himself; put his own hand to the plough; worked hard; ate heartily; slept soundly; paid for every thing in cash down; and never danced except he could do it to the music of his own money in both pockets. He has never been without a hundred or two hundred pounds in gold by him, and never allows a debt to stand unpaid. This has gained him his current name, of which, by the by, he is a little proud; and has caused him to be looked upon as a very wealthy man by all the village.

Notwithstanding his thrift, however, he has never denied himself the amusements of life, but has taken a share in every passing pleasure. It is his maxim, that "he that works hard can afford to play." He is, therefore, an attendant at all the country fairs and wakes, and has signalized himself by feats of strength and prowess on every village green in the shire. He often makes his appearance at horse-races, and sports his half-guinea and even his guinea at a time; keeps a good horse for his own riding, and to this day is fond of following the hounds, and is generally in at the death. He keeps up the rustic revels, and hospitalities too, for which his paternal farm house has always been noted; has plenty of good cheer and dancing at harvest-home, and, above all, keeps the "merry night," as it is termed, at Christmas.

With all his love of amusement, however, Jack is by no means a boisterous jovial companion. He is seldom known to laugh even in the midst of his gaiety; but maintains the same grave, lion-like demeanour. He is very slow at comprehending a joke; and is apt to sit puzzling at it, with a perplexed look, while the rest of the company is in a roar. This gravity, has, perhaps grown on him with the growing weight of his character; for he is gradually rising into patriarchal dignity in his native place. Though he no longer takes an active part in athletic sports, yet he always presides at them, and is appealed to on all occasions as umpire. He maintains the peace on the village green at holiday games, and quells all brawls and quarrels by collaring the parties and shaking them heartily, if refractory. No one ever pretends to raise a hand against him, or to contend against his decisions; the young men having grown up in habitual awe of his prowess, and in implicit deference to him as champion and lord of the green.

He is a regular frequenter of the village-inn, the landlady having been a sweetheart of his in early life, and he having always continued on kind terms with her. He seldom, however, drinks any thing but a draught of ale; smokes his pipe, and pays his reckoning before leaving the tap-room. Here he gives his little senate laws; decides bets, which are very generally referred to him; determines upon the characters and qualities of horses; and indeed plays now and then the part of a judge, in settling petty disputes between neighbours, which otherwise might have been nursed by country attornies into tolerable law-suits.

Jack is very candid and impartial in his decisions, but he has not a head to carry a long argument, and is very apt to get perplexed and out of patience if there is much pleading. He generally breaks through the argument with a strong voice, and brings matters to a summary conclusion, by pronouncing what he calls the "upshot of the business," or, in other words, "the long and the short of the matter."

Jack once made a journey to London a great many years ago, which has furnished him with topics of conversation ever since. He saw the old king on the terrace at Windsor, who stopped, and pointed him out to one of the princesses, being probably struck with Jack's truly yeomanlike appearance. This is a favorite anecdote with him; and has no doubt had a great effect in making him a most loyal subject ever since, in spite of taxes and poor's-rates. He was also at Bartholomew fair, where he had half the buttons cut off his coat; and a gang of pick-pockets, attracted by his external show of gold and silver, made a regular attempt to hustle him as he was gazing at a show, but for once they found that they had caught a Tartar; for Jack enacted as great wonders among the gang as Samson did among the Philistines. One of his neighbours, who had accompanied him to town, and was with him at the fair, brought back an account of his exploits, which raised the pride of the whole village; who considered their champion as having subdued all London, and eclipsed the achievements of Friar Tuck, or even the renowned Robin-Hood himself.

Of late years the old fellow has begun to take the world easily; he works less, and indulges in greater leisure, his son having grown up and succeeded to him both in the labours of the farm, and the exploits of the green. Like all sons of distinguished men, however, his father's renown is a disadvantage to him, for he can never come up to public expectation. Though a fine active fellow of three and twenty, and quite the "cock of the walk," yet the old people declare he is nothing like what Ready-money Jack was at his time of life. The youngster himself acknowledges his inferiority, and has a wonderful opinion of the old man, who indeed taught him all his athletic accomplishments, and holds such a sway over him, that I am told, even to this day, he would have no hesitation to take him in hands, if he rebelled against paternal government.

The squire holds Jack in very high esteem, and shows him to all his visiters as a specimen of Old English "heart of oak." He frequently calls at his house, and tastes some of his home-brewed, which is excellent. He made Jack a present of old Tusser's "Hundred Points of Good Husbandrie," which has furnished him with reading ever since, and is his text-book and manual in all agricultural and domestic concerns. He has made dog's-ears at the most favoured passages, and knows many of the poetical maxims by heart.

Tibbetts, though not a man to be daunted and fluttered by high acquaintances; and, though he cherishes a sturdy independence of mind and manner, yet is evidently gratified by the attentions of the squire, whom he has known from boyhood, and pronounces a "true gentleman every inch of him." He is also on excellent terms with Master Simon, who is a kind of privy-counsellor to the family; but his great favourite is the Oxonian, whom he taught to wrestle and play at quarter-staff when a boy, and considers the most promising young gentleman in the whole county.

THE SCHOOL-MASTER.

Among the worthies of the village, that enjoy the peculiar confidence of Master Simon, is one who has struck my fancy so much, that I have thought him worthy of a separate notice. It is Slingsby, the school-master, a thin elderly man, rather threadbare and slovenly, somewhat indolent in manner, and with an easy, good-humoured look, not often met with in his craft. I have been interested in his favour by a few anecdotes which I have picked up concerning him.

He is a native of the village, and was a contemporary and playmate of Ready-money Jack in the days of their boyhood. Indeed they carried on a kind of league of mutual good offices. Slingsby was rather puny, and withal somewhat of a coward, but very apt at his learning: Jack, on the contrary, was a bully-boy out of doors, but a sad laggard at his books. Slingsby helped Jack, therefore, to all his lessons; Jack fought all Slingsby's battles; and they were inseparable friends. This mutual kindness continued even after they left the school, notwithstanding the dissimilarity of their characters. Jack took to ploughing and reaping; and prepared himself to till his paternal acres; while the other loitered negligently on in the path of learning, until he penetrated even into the confines of Latin and mathematics.

In an unlucky hour, however, he took to reading voyages and travels, and was smitten with a desire to see the world. This desire increased upon him as he grew up; so, early one bright sunny morning, he put all his effects in a knapsack, slung it on his back, took staff in hand, and called in his way to take leave of his early schoolmate. Jack was just going out with the plough: the friends shook hands over the farm-house gate; Jack drove his team afield, and Slingsby whistled "over the hills and far away," and sallied forth gaily to seek his fortune.

Years and years passed by, and young Tom Slingsby was forgotten; when, one mellow Sunday afternoon in Autumn, a thin man, somewhat advanced in life, with a coat out at elbows, a pair of old nankeen gaiters, and a few things tied in a handkerchief, and slung on the end of a stick, was seen loitering through the village. He appeared to regard several houses attentively, to peer into the windows that were open, to eye the villagers wistfully as they returned from Church, and then to pass some time in the church-yard reading the tombstones.

At length he found his way to the farm-house of Ready-money Jack, but paused ere he attempted the wicket; contemplating the picture of substantial independence before him. In the porch of the house sat

Ready-money Jack, in his Sunday-dress: with his hat upon his head, his pipe in his mouth, and his tankard before him, "the monarch of all he surveys." Beside him lay his fat house-dog. The varied sounds of poultry were heard from the well-stocked farm-yard; the bees hummed from their hives in the garden; the cattle lowed in the rich meadow; while the crammed barns and ample stacks bore proof of an abundant harvest.

The stranger opened the gate and advanced dubiously towards the house. The mastiff growled at the sight of the suspicious-looking intruder; but was immediately silenced by his master; who, taking his pipe from his mouth, awaited with inquiring aspect the address of this equivocal personage. The stranger eyed old Jack for a moment, so portly in his dimensions, and decked out in gorgeous apparel; then cast a glance upon his own threadbare and starveling condition, and the scanty bundle which he held in his hand, then giving his shrunk waistcoat a twitch to make it meet his receding waist-band; and casting another look half sad, half humourous at the sturdy yeoman, "I suppose," said he, "Mr. Tibbetts, you have forgot old times and old play-mates."

The latter gazed at him with scrutinizing look, but acknowledged that he had no recollection of him.

"Like enough, like enough," said the stranger; "every body seems to have forgotten poor Slingsby!"

"Why, no, sure! it can't be Tom Slingsby!"

"Yes, but it is, though!" replied the stranger, shaking his head.

Ready-money Jack was on his feet in a twinkling; thrust out his hand, gave his ancient crony the gripe of a giant, and slapping the other hand on a bench, "Sit down there," cried he, "Tom Slingsby!"

A long conversation ensued about old times, while Slingsby was regaled with the best cheer that the farm-house afforded; for he was hungry as well as wayworn, and had the keen appetite of a poor pedestrian. The early playmates then talked over their subsequent lives and adventures. Jack had but little to relate, and was never good at a long story. A prosperous life, passed at home, has little incident for narrative; it is only poor fellows, that are tossed about the world, that are the true heroes of story. Jack had stuck by the paternal farm, followed the same plough that his forefathers had driven, and had waxed richer and richer as he grew older. As to Tom Slingsby, he was an exemplification of the old proverb, "a rolling stone gathers no moss." He had sought his fortune about the world, without ever finding it, being a thing oftener found at home than abroad. He had been in all kinds of situations, and had learnt a dozen different modes of making a living; but had found his way back to his native village rather poorer than when he left it, his knapsack having dwindled down to a scanty bundle.

As luck would have it, the squire was passing by the farm-house that very evening, and called there as is often his custom. He found the two school-mates still gossiping in the porch, and, according to the good old Scottish song, "taking a cup of kindness yet, for auld lang syne." The squire was struck by the contrast in appearance and fortunes of these early playmates. Ready-money Jack, seated in lordly state, surrounded by the good things of this life, with golden guineas hanging to his very watch-chain; and the poor pilgrim, Slingsby, thin as a weasel, with all his worldly effects, his bundle, hat, and walking-staff, lying on the ground beside him.

The good squire's heart warmed towards the luckless cosmopolite, for he is a little prone to like such half-vagrant characters. He cast about in his mind how he should contrive once more to anchor Slingsby in his native village. Honest Jack had already offered him a present shelter under his roof, in spite of the hints, and winks, and half-remonstrances of the shrewd Dame Tibbetts: but how to provide for his permanent maintenance was the question. Luckily the squire bethought himself that the village school was without a teacher. A little further conversation convinced him that Slingsby was as fit for that as for any thing else, and in a day or two he was seen swaying the rod of empire in the very school-house, where he had often been horsed in the days of his boyhood.

Here he has remained for several years, and, being honoured by the countenance of the squire and the fast friendship of Mr. Tibbetts, he has grown into much importance and consideration in the village. I am told, however, that he still shews, now and then, a degree of restlessness, and a disposition to rove abroad again, and see a little more of the world; an inclination which seems particularly to haunt him about spring-time. There is nothing so difficult to conquer, as the vagrant humour, when once it has been fully indulged.

Since I have heard these anecdotes of poor Slingsby, I have more than once mused upon the picture presented by him and his school-mate Ready-money Jack on their coming together again after so long a separation. It is difficult to determine between lots in life, where each is attended with its peculiar discontents. He who never leaves his home repines at his monotonous existence, and envies the traveller, whose life is a constant tissue of wonder and adventure; while he, who is tossed about the world, looks back with many a sigh to the safe and quiet shore which he has abandoned. I cannot help thinking, however, that the man who stays at home, and cultivates the comforts and pleasures daily springing up around him, stands the best chance for happiness. There is nothing so fascinating to a young mind as the idea of travelling; and there is very witchcraft in the old phrase, found in every nursery tale, of "going to seek one's fortune." A continual change of place and of object promises a continual succession of adventure and gratification of curiosity. But there is a limit to all our enjoyments, and every desire bears its death in its very gratification. Curiosity languishes under repeated stimulants, novelties cease to excite surprise, until at length we cannot wonder even at a miracle. He who has sallied forth into the world, like poor Slingsby, full of sunny anticipations, finds too soon how different the distant scene becomes when visited. The smooth place roughens as he approaches; the wild place becomes tame and barren; the fairy tints that beguiled him on, still fly to the distant hill, or gather upon the land he has left behind, and every part of the landscape seems greener than the spot he stands on.

POETRY.

Dulces ante omnia Musæ. VIRGIL.

THE WIDOW.

SAY, hast thou heard the widow'd dove,
In melting tone,
Her mate bemoan?
And did the song of grieving love
Within thine harp-like bosom move
The silken chord of sympathy?

Yes! it hath oft been heard by thee;
And in thy breast
The chord was prest—
The silken chord of sympathy—
As by the faint breath of each sigh,
The widow heaved - - -

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Behold yon form, whose shade and seat,
Are the yew's dark gloom
And the marble tomb!
And tell me, who or what is it?—
"'Tis garb, and place, and posture meet,
For one who mourns her husband dead."—

E'en so it is, boy! thou hast said:
A beauty once,
Her blue eye's glance
Was like an arrow surely sped,
And many a fond youth she led,
To woo her, but to be told "nay!"

Thus did the lovely maiden play,
Till Ethelbert
Did win her heart ;
And then all others fled away ;
With him alone she spent the day,
With him—in dreams alone —the night.

But ah ! mankind is fragile quite !
For when their joy
Had least alloy,
The youthful husband took his flight
To regions of immortal light,
Leaving a smiling babe behind.

O ! Ethelbert was good, and kind,
And bountiful,
And he did cull
The fairest flow'rets of the mind
From lettered gardens, that the wind
Of his words might their odours breathe.

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Calm and unruffled was the wave
On which they sailed,
Till his bark failed.—
He sank, and then *her* vessel drave,
Nor will it rest her, till the grave
Opes to receive the shattered wreck.

N'Importe !

MAN THE GREAT FOE OF MAN.

Mr. Southey has once more been agreeably employed in editing an additional volume (the third) of the Remains of Henry Kirke White, the contents of which, though not equal in interest to those of either of the preceding volumes, are yet sufficiently captivating, and characteristic of their lamented author, to merit some notice in the Leeds Correspondent. To give a greater publicity to these fragments of genius we have transported into our poetical Department the following extracts ; and one of his familiar and instructive letters is immediately subjoined.

In every clime, from Lapland to Japan,
This truth's confest, that man's worst foe is man.
The rav'ning tribes, that crowd the sultry zone,
Prey on all kinds and colours, but their own.

Lion with lion herds, and pard with pard,
Instinct's first law, their covenant and guard.
But man alone, the lord of every clime,
Whose post is godlike, and whose powers sublime,
Man, at whose birth th'Almighty hand stood still,
Pleased with the last great effort of his will;
Man, man alone, no tenant of the wood,
Preys on his kind, and laps his brother's blood;
His fellow leads, where hidden pit-falls lie,
And drinks with extacy his dying sigh.

THE HOUSELESS POOR.

Drear Winter! who dost knock
So loud and angry on my cottage roof
In the loud night-storm wrapt, while drifting snows
The cheerless waste invest, and cold, and wide,
Seen by the flitting star, the landscape gleams;
With no unholy awe I hear thy voice,
As by my dying embers, safely hous'd,
I, in deep silence, muse. Though I am lone,
And my low chimney owns no cheering voice
Of friendly converse; yet not comfortless
Is my long evening, nor devoid of thoughts
To cheat the silent hours upon their way.
There are, who in this dark and fearful night,
Houseless, and cold of heart, are forced to bide
These beating snows, and keen relentless winds—
Wayfaring men or wanderers whom no home
Awaits, nor rest from travel, save the inn
Where all the journeyers of mortal life
Lie down at last to sleep. Yet some there be
Who merit not to suffer.—Infancy,
And sinew-shrinking age are not exempt
From penury's severest, deadliest gripe.
Oh, it doth chill the eddying heart's-blood to see
The guileless cheek of infancy turned blue
With the keen cold.—Lo, where the baby hangs
On his wan parent's hand; his shiv'ring skin
Half bare, and opening to the biting gale.
Poor shiv'rer, to his mother he upturns
A meaning look in silence! then he casts

Askance, upon the howling waste before,
A mournful glance upon the forward way—
But all lies dreary, and cold as hope
In his forsaken breast.

THE YOUTHFUL DESIRE.

A FRAGMENT.

When pride and envy, and the scorn
Of wealth, my heart with gall embued,
I thought, How pleasant were the morn
Of silence in the solitude:
To hear the forest bee on wing;
Or by the stream, or woodland spring,
To lie and muse alone,—alone,
While the tinkling waters moan:
Or such wild sounds rise as say,
"Man and noise are far away."

Now, surely, thought I, there's enow
To fill life's dusty way;
And who will miss a poet's feet,
Or wonder where he stray?
So to the woods and waste I'll go:
And I will build an osier bower,
And sweetly there to me shall flow
The meditative hour.

And when the autumn's withering hand
Shall strew with leaves the sylvan land,
I'll to the forest caverns hie;
And in the dark and stormy nights
I'll listen to the shrieking sprites;
Who, in the wintry wolds and floods,
Keep jubilee, and thread the woods;
Or, as 'tis drifted soft and slow,
Hurl in ten thousand shapes the snow.

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TO * * * *

Wintringham, March, 1805.

Dear K.,

I greatly fear that you and W * * * have not persevered in your laudable undertaking. The Latin language might be useful to both of you, and as you have leisure, you might employ it advantageously to this purpose. I do assure you, it is not difficult to attain a sufficient knowledge of the language to read easy authors; and that when you have done that, you may, with continued application, speedily read the Greek Testament. Tell me what are your determinations on this head. I must give you one piece of advice, however, which is, that neither languages, nor any other valuuble attainments, are to be taken by storm; continued, sedulous, and unwearied application must be employed for the accomplishment of any valuable purpose. The stone, which force could not break, is worn through by the incessant dropping of water. Persons at our age ought to begin to acquire comprehensive views of things and to embrace knowledge, at least in her outlines, with some degree of universality. For this end all languages are useful, but not indispensable. Translations answer most of the purposes of a knowledge of the original, although they neither convey so much satisfaction, nor impart so much pleasure. To learn a language for the sake of knowing it, without any view to the extension of our general knowledge, or other beneficial ends, is quite absurd; and I cannot for a moment suspect you of such a motive: I know your design is to enlarge the means of information, and to unlock stores which have hitherto been withheld from you. I exhort you to proceed, and I pray, that as you begin your studies with proper motives, you may be enabled to pursue them with an eye to the glory of God, and to the establishment of his truth.

We have it, all of us, in our power, in a greater or less degree, to be useful to our fellow-pilgrims; and it is our duty, as well to employ the means we at present enjoy to this purpose, as to endeavour to enlarge those means. Now, I think, it is tolerably manifest, that the more extensive a man's knowledge under proper regulations be, the less likely is he to be deceived by delusive impostures, or misled by specious errors. Such a man, in religion, is like a bulwark to the church, the detector of fallacies, and the opposer of dangerous innovations. Those who have a studious turn should, therefore, make a conscience of directing their pursuits to the proper end, in order that they may answer those purposes for which God intended them; yet we must guard most carefully against the pride of learning, and the pride of reason. If we once throw off our dependance on God, exult in our own wisdom, and rely on our own discernment, our knowledge will prove a snare and a destruction to us. A studious man stands in need of almost unceasing supplications for God's superintending and directing hand; he may so easily be deluded by proud logic and proud enquiries.

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H. K. W.

SCIENTIFIC INFORMATION.

It has been found, by experiment, that the coal-tar liquor, which is sometimes considered as waste by those who make gas, if mixed with dry saw-dust, exhausted logwood, or fustic. to the consistence of paste, and allowed to remain till the water has drained off, two cwt. of the mass being put into the retort instead of coal will produce more gas, and be less offensive than the same quantity of canal coal. This process will probably be found very convenient in some circumstances for the consumption of the tar produced by the distillation of coal in gas-works.

An immense skeleton of a mammoth, and another of an elephant, have been dug up, in the district of Honter in Hungary.

A French artist, M. Thomas, of Colmar, honorary director of the Phœnix company, has obtained a brevet of invention (patent,) for a machine of calculation, to be called the arithmometer. It has been presented to the Society for the encouragement of National Industry, and by it a person unacquainted with figures may be made to perform, with wonderful promptitude, all the rules of arithmetic. The most complicated calculations are done as readily and exactly as the most simple; sums in multiplication and division of seven or eight figures require no more time than those of two or three.

In the last number of the American Journal of Science, Professor Silliman has given an account of a six-pound shot found at Newhaven Harbour, and supposed to have been there ever since 1779, which was encrusted with a shapeless, rusty brownish substance, unctuous, sectile, and leaving a mark on paper like plumbago. Various facts of the same kind have been observed in this country; and very recently Mr. Hatchett obtained from Mr. Whidbey at Plymouth a portion of a cast-iron gun which had been long immersed in sea-water. Mr. Brande found it to consist of Oxide of Iron 81, and Plumbago 16; and he attributes the rapid decay and change in the cast-iron "to a galvanic action, the plumbaginous crust in contact with the cast-metal producing an electro-motive combination, aided by and promoting the decomposition of the sea-water, and of its saline contents."—See *Quarterly Journal*, vol. xii, p. 407. The late Mr. James Watt long ago remarked this change in cast-iron, in the pumps of his steam-engines that had been exposed to the action of salt-water. *Edin. Philos. Journal.*

Dr. Caleb Miller has, in Silliman's Journal, stated the success he obtained in cases of jaundice, by the use of phosphoric acid. His practice is to give a cathartic of calomel and julip, or some of the neutral salts, and then balm-tea moderately acidulated with the phosphoric acid, which is to be continued till it operates as a diuretic, and until the urine becomes clear, or nearly so. One patient had taken eight pints in twenty-four hours. In general the yellowness disappears in three or four days from the urine, and in a few days more from the skin. Dr. Miller has met with but one case, (a person eighty years of age,) that had not yielded to this treatment.

In carrying the Union Canal through Ratho Bog, on the estate of Bonnington, and county of Mid-Lothian, it was necessary to execute some very deep cutting at Wilkie's Hill, at the head of the bog. After descending through *nine* feet of *moss*, and *seven* feet of sand, the workmen came to the hard, black till-clay; and at the depth of *four* feet below its junction with the stratum of sand, they found the head of a battle axe, of an unusual kind. It consists wholly of pure copper. Its length is *four inches five tenths and a half.* Its *maximum* breadth, or the chord of its circular cutting edge, is *three inches;* and its least breadth, *two inches.* Its cutting edge is composed as it were of two edges of different inclinations, and as it has no provision made in the metal for the reception of a handle, it must have been fixed by a string, or some other means, into the cleft at the end of the handle, like the Steinbartes of Shetland. It possesses a peculiar interest from the depth at which it was found. It must have been deposited along with the blue clay, prior to the formation of the superincumbent stratum of sand; and must have existed before the diluvial operations by which that stratum was formed. This opinion of its antiquity is strongly confirmed by the peculiarity of its shape, and the nature of its composition.

Professor Pictet communicated to the Helvetic Society an account of a singular effect produced by a stroke of lightning on the 3d of July last. The house had no conductors, but its roof was covered with white iron, and had bars of the same metal communicating with the ground. The stroke of lightning did no damage to the house, but the lightning perforated a piece of white iron with *two holes*, of an inch in diameter, and five inches distant; and, what was very remarkable, the *burs at the edges of the holes were in opposite directions.* "Hence," as Professor Pictet remarks, "it appears to follow, either that the electric fluid has passed through the white iron, forming one hole, and, after moving five inches along it, has penetrated it again in an opposite direction; or that two currents of electric fluid had moved simultaneously in opposite directions, and at the distance of five inches from each other."

Among the Malayan plants, of which Dr. Jack has sent specimens over to England, is the *Camphor-tree, (Dryobalanops Camphora).* Specimens of this tree in flower (Dr. Jack observes) were sent by Mr. Prince from Tapanooly to Sir T. S. Raffles, in 1819. In Sumatra, the camphor-trees are confined to the country of the Battas, which extends about a degree and a half to the north of the Equator. They are also found in Borneo, in nearly the same parallel of latitude; and Dr. Jack thinks there are some in the neighbourhood of Singapore and Johore. This valuable tree, Dr. Jack informs us, is not known to exist in any other part of the world; and, on this account, as well as the difficulty of obtaining its produce, this kind of camphor bears a very high price. It is all carried to China, where it sells for about twelve times as much as that of Japan. The camphor is found in a concrete state, in cavities and fissures in the heart of the tree. In order to obtain it, the tree is felled and split into lengths, to allow of the extraction of the crystallized masses. The same trees afford both the concrete substance and an oil, which is supposed to be the first stage of the formation of the camphor. The Sumatran camphor is little known in Europe, and it would perhaps, Dr. Jack observes, deserve examination, to ascertain how far its properties differ from those of the common kind. It appears to be less volatile, and its odour is not so diffusive.

In subjecting rubies to high degrees of heat, Dr. Brewster observed a very singular effect produced during their cooling. At a high temperature, the *Red Ruby* becomes *Green;* as the cooling advances, this green tint gradually fades, and becomes *Brown,* and the redness of this brown tint gradually increases till the mineral has recovered its primitive brilliant red colour. A green ruby suffered no change from heat; and a bluish-green sapphire became much paler at a high heat, but resumed its original colour by cooling.

Mr. N. Bowditch has published, in the Memoirs of the American Academy of Arts and Sciences, a very full account of the large and brilliant meteor which was seen on the 21st November, 1819, at such a height above the earth, that it was visible at the same time in Danvers, Massachussets, Baltimore, and Maryland, by persons above 380 miles distant from each other. The size was equal to that of the moon; its first appearance was marked by a quantity of falling sparks; and two minutes after losing sight of it, a rumbling noise, like distant and protracted peals of thunder, was heard for upwards of 90 seconds. The light was equal to that of the sun when just emerging from the horizon. Its apparent direction over the earth's surface was nearly S. 44 deg. W. The duration of its appearance was about 16 seconds, *and its velocity was about seven miles and a half* per *second.* Its actual diameter appeared to be about 2710 feet, or nearly *half a mile.*

The oranges of St. Michael are celebrated for their fine flavour, and abundant sweet juice; when left to ripen on the trees, they are inferior to none in the world. The lemons have less juice than those of some other countries, and the demand for them is inconsiderable. The orange and lemon trees blossom in the months of February and March. At this time, the glossy green of the old leaves, the light fresh tints of those just shooting forth, the brilliant yellow of the ripe fruit, and the delicate white and purple of the flower, are finely contrasted with each other, presenting one of the most beautiful sights imaginable. The trees generally attain the height of fifteen or twenty feet. The usual produce of a good tree, in common years, is from 6000 to 8000 oranges or lemons. Some instances of uncommon productiveness have occurred; a few years since, 26,000 oranges were obtained from one tree, and 29,000 have been gathered from another. These quantities have never been exceeded.

M. Pictet relates, that whilst engaged in examining some subterraneous excavations in a bed of lava, near Niedermendig, he had occasion to observe a fact that had previously drawn his attention in many natural caverns in the midst of summer, and of which he had not yet found an explanation. "I observed, (says he,) in some places water falling drop by drop from the roof on to the floor, or against the sides of the cavern. Wherever this happened, there was beneath, a mass of ice of a certain thickness; nevertheless the temperature of the air was 3.5 R (39.8 deg. F.), and I believe that at no time did it ever descend to Zero in these subterraneous places."—*Geneva Memoires*, i. p. 151.

The dreadful gale which blew the 3d September, 1821, at Newhaven from the S. E. gradually increased from noon till dark, when it raged with tremendous violence, and continued till near midnight. "It terminated very abruptly, and passed in a very short time from a hurricane to a serene and starlight night. Near midnight, a loud report was heard by many, and it was observed that the wind ceased immediately after." Next morning, the windows were found covered with salt; the trees exhibited a blasted foliage; in a few hours, the leaves began to shrink and dry on the windward side, and after some days the dry leaves fell, as they ordinarily do in the latter end of November. In October, the leaves re-appeared on the windward side of the trees, new blossoms were put forth, and the watermelon and the cucumber produced new fruit. In some instances, the mature fruit was found on the same tree with the new blossoms. On the morning after the tempest, the leaves were perceptibly saline to the taste at Hebron, 30 miles from the sea; and it is stated, that the same effect was observed at Northampton, more than 60 miles inland —See *American Journal of Science*, vol. iv, p. 172.

Among the observatious that M. Brocchi lately made on the different formations of rocks in Sicily, there is one which merits particular attention. On Mount Pellegrino, near Palermo, he remarked at different heights, above the level of the sea, a number of holes which were formed by the mytilus lithophagus; they are often to be met with in such large quantities, that they resemble honeycombs. They were found even to the summit of the mountain, which, according to the observation of the astronomers of Palermo, rises 1850 French feet above the level of the Mediterranean, and proves how much that sea must have subsided. M. Brocchi observed, that this mountain was a complete *Nilometer*. He also says, that he has met with the same appearance at the height of thirty and forty feet above the sea in Hither Calabria, between Fuscaldo and Scalea, towards the promontory of Palinurus, and also in ulterior Calabria on the coast of the Ionian sea.

Between five and six o'clock of the evening of the 12th July 1820, a fire-ball, about the size of the full moon, and burning with a reddish flame and tint, was seen moving slowly from S. to N. After describing an arch of 100 degrees, it became extinguished, and its extinction was followed with a noise like three rapid discharges of great guns, or fire of musquetry, and a continued rolling. At that moment, a stone fell about three German miles and a half from the country palace of Lixna, in the circle of Dunaberg. The stone penetrated one foot and a half into a clayey loam. It weighed 40 lbs., had the smell of gunpowder, and was hot to the touch. At the same time, a large body fell about four wersts distant into the lake Kolupschen with a hissing noise, and dashing the spray high into the air. Three wersts in the opposite direction, something fell into the river Dubna, which made its water turbid for about an hour.

Dr. Henkesew, a physician at Hildesheim, has been in the habit of prescribing Sub-nitrate of Bismuth in agues, for several years. He considers it to be a powerful febrifuge and anti-spasmodic. He exhibits this salt in the dose of four grains, with a few grains of sugar every two hours.

A very necessary precaution with respect to the use of chronometers, is, always to hang them up on board ship at a considerable distance from the compasses. Mr. P. Lecount says, "I have known an excellent chronometer rendered useless for the time, by being kept within two feet of the cabin compass, and which, when removed to a different part of the cabin, performed remarkably well."

Dr. M'Keever of Dublin, whilst reasoning on the formation of Ice in the beds of Riverr, which has never yet been well explained, suggests, that it may be occasioned by radiation, just in the way that hoar frost is formed. It is mentioned from the observations of Mr. Garnet, that such ice is seldom seen adhering to any substance except rock, stones, or gravel; that it is always found in greatest abundance in proportion to the magnitude and number of the stones composing the bed of the river, combined with the velocity of the current; and that it does not occur, where mud or clay is deposited. Dr. M'Keever thinks it probable, that in consequence of the greater radiating powers, as regards heat, of these substances on which the ice is deposited, an effect of depression of temperature may be produced by the heat they throw off into space, sufficient, when it takes place in water nearly at the freezing point, to decide the formation of ice at their surface; and the rapidity of the current of cold water, he thinks, may be active in reducing the temperature of the bed of the river more rapidly, as well as in removing the heat evolved by the congelation of the successive portions of water. The great objection to this theory, it is remarked, is Professor Leslie's statement, that no radiation takes place in water; but it is justly observed, that from the evident difficulty of making the experiment accurately, that point is not yet decided. *Ann. Phil.* iii. 187.

In accounting for the extraordinary darkness that was observed in some parts of the United States and Canada, in Nov. 1819, Professor Hall says, "The atmosphere had been very smoky for about a fortnight preceding; so much so, that it had literally intercepted the rays of the sun at noon during a part of this time, and seriously affected the eyes. It was doubtless occasioned by great fires in the Indian territories. The wind blew almost invariably from that direction for some time. I think it can scarcely be questioned that this darkness had its origin in some of our most southern states, or in the territories belonging to them. It is by no means improbable that it was occasioned by fires, running on those immense *prairies* that furnish annually such vast quantities of combustible materials. We are told that these prairies 'are covered with a coarse kind of grass, which, before the country is settled in their vicinity, grows to the height of six or seven feet.' This vegetation, another writer observes, 'becomes sufficiently dry to burn during the long dry season, called the *Indian Summer*; which commences usually in October, and continues a month and a half or two months, during which the vegetation is killed by the frost, and dried by the sun; the wet prairies are also dried, and before the season has expired, the grass is perfectly combustible.' In order the more easily to take their game, and to facilitate travelling from one hunting ground to another, the Indians, we are informed, occasionally set fire to the prairies 'towards the close of the Indian summer.'"

Dr. Macartney of the Dublin University, has for some time employed a solution of alum and nitre, for the purpose of preserving anatomical preparations. He finds that it preserves the natural appearances of most parts of the body more completely than spirits or any other fluid heretofore used. The proportions of the alum and the nitre, and the strength of the solution, require to be varied according to circumstances; and, in order to thoroughly impregnate the anatomical preparation, the liquor must for some time be occasionally renewed. The solution possesses such antiseptic powers, that the most putrid and offensive animal substances are rendered perfectly free from fœtor by it in a few days. *Med. Rep.* xvii. p. 169.

The following account of rock-crystal found in primitive marble, is from an Essay on the African Alps, and the marble of Carrara, by M. Ripetti, of Florence.—" There is frequently found, in the hollow crystalline cavities at Carrara and elsewhere, a very limpid liquid, slightly sapid, and more or less abundant. I have lately had occasion to verify this fact, very common as I have been told in the valley of the Upper Pianello. There I have not only found in these cavities prismatic crystals, but I have seen a very transparent and slightly acid liquid come out of them as the workmen had said; and, who further add, that they sometimes find it in such quantityas to quench their thirst with it, being led to the place by the appearance of the *lucica*. This is not all, and that which follows is still more extraordinary. In the spring of 1819, M. del Nero, proprietor of an excavation in the Fossa de l'Angelo, being engaged in sawing out the shaft of a large column of the required length for the temple of St. Francois at Naples, discovered a *lucica* in the interior of the marble, about which the workmen penetrated the rock, and found a cavity much larger than usual, lined with crystals, and containing above a pound and a half of the fluid in question. In this cavity there was seen also with astonishment a protuberance as large as the fist, transparent, and which appeared to have all the other characters of rock-crystal. M. del Nero delighted to find himself possessor of one of the finest specimens of hyalin quartz which had ever been seen in the country, endeavoured to raise it at the base, but to his inexpressible surprise he found an elastic and pasty substance, which took any form he pleased under his hand, but which was not long becoming hard, and taking on the appearance of calcedony or porcelain. Provoked by the circumstance, the proprietor threw it from him amongst the fragments of the rocks, where this specimen, which would have interested the curious so highly, was lost. He affirmed to me, and his assertion was repeated by other witnesses worthy of confidence, that the same fact has occurred more than once, and I made him promise that if he again had the opportunity, he would impress some seal on the soft matter, and when hard send it to me at Florence, with the water which the cavity might contain." This is a very extraordinary account, but it is given with every appearance of ingenuousness and conviction.

Bib. Univ. xviii. 203.

To make Japanners' Gold-size,—take gum-anime, one ounce; asphaltum, one ounce; litharge of gold, red-lead, and brown amber, each half an ounce, Put these ingredients into a new-glazed earthen pipkin, large enough to contain one-third more than the whole quantity of ingredients to be boiled. Next add a quarter of a pint of raw linseed-oil, and half a pint of linseed-oil rendered drying. The whole must then be heated over a gentle fire, which does not flame in the least; so that the mixture may only just bubble up or almost boil: For, should it boil and rise over the edges of the pipkin, great danger might arise: Therefore, in case of its swelling up, to prevent its boiling over, remove the pipkin from the fire till the mixture again subsides. On beginning to boil, it must be well stirred with a stick, until the soluble ingredients are incorporated and it becomes as thick as treacle, when it may be cooled, and strained through a coarse cloth for use.

In a paper *on the ventilation of rooms*, by D. Gilbert, Esq., F. R. S., inserted in *the Journal of the Royal Institution*, the following observations occur: "When currents of air find their way down a flue, in consequence of reverberation from adjacent buildings, or in consequence of a direction inclined to the horizon, which may have been acquired by passing over more lofty obstacles, remedies must be sought by elevating the stack, or by the use of mechanical contrivances. When ample space is required round a fire for culinary purposes, the flue must continue all the way of a proportionate size, and so terminate, or the whole of the elastic fluids will not be able to ascend, and to escape into the air. But, when the only purpose of a fire is to diffuse warmth through an apartment, the line of communication into the chimney should be reduced to much narrower limits, which, to produce the greatest effect, should vary with the state of the fire: whether it is just kindled, has fresh coal thrown on it, or whether it burns clear and with a red heat: and these cases have recently been met by the contrivance of a moveable plate inclined forwards, so as to reach within about three inches of the front of the chimney, but capable of being pushed back against the further wall. To afford the means of a still more accurate adjustment; a small moveable plate is frequently inserted towards the lower part of the large one. It seems clear that the section of the flue should at the least exceed these as four-fold, the average size of the aperture communicating with the fireplace, but that at the top it should be much contracted. All descent of cold air into the chimney will then be prevented, which, by reducing the temperature, like extraneous air ascending, would equally retard the draft; and the effects of irregular, temporary movements of the atmosphere will be rendered insensible. These appear to be the chief advantages derived from earthen tubes, very frequently seen on the tops of chimneys, which in most cases make but a very insignificant addition to the length of the flue. Those stoves or fire-places are constructed on the best principles which throw the greatest quantity of radiant heat into the rooms they are intended to warm, and at the same time take away the least quantity of heated air."

Composition ornaments are formed of glue, linseed-oil, and whiting, mixed and well kneaded together, and pressed into dies or moulds by the force of a screw-press; and afterwards dried for use. In some cases they are employed whilst in the undried or pliant state, for the convenience of gluing, or applying them to the round or hollow surfaces of the articles which they are intended to decorate. When they are to receive the forms of *beads, husks, &c.*, strings are placed in the moulds, and inclosed in the composition, to connect them together.

It occurred some time ago to Mr. Arthur Aikin, the ingenious Secretary to the Society of Arts and Manufactures, that melted caoutchouc would be found to preserve the surface of iron goods from oxidation, by the action of the atmosphere, in consequence of its undergoing almost no chemical change when exposed to the air,—its treacly consistence under ordinary degrees of heat,—its powerful adhesion to iron or steel surfaces,—and the facility with which it can be removed by a soft rag and a piece of stale bread. The truth of this conjecture was afterwards established by direct experiment. Plates of iron and steel that had one half of their surfaces covered with caoutchouc, remained unoxidated, while the unprotected parts were almost wholly corroded by exposure for five or six weeks in a laboratory. The caoutchouc must be melted in a close vessel, to prevent it from being charred, and from taking fire. It melts nearly at the temperature at which lead fuses; and, when in a fluid state, it must be stirred with a horizontal agitator, by means of a handle rising above the vessel to prevent the caoutchouc (or Indian Rubber,) from burning to the bottom.

CLASSIFICATION OF MEDICAL MEN.

A Resident Physician in Bath concludes a paper *On the neglect of the Bath waters*, thus: "I would rather caution them against placing implicit belief in those persons who employ, in every disease, any single remedy, or any particular mode of treatment, to the exclusion of all others,—an error into which the more superficial professors of the healing art have at all times fallen. Accordingly, Gideon Harvey, in his very severe satire upon those of the seventeenth century, has divided them into the following sects, according to their peculiar and exclusive modes of treating diseases. 1. ORAREO-FERREO-MEDICI, who cured all their patients with preparations of iron. 2. ASINARII DOCTORES. The patients of these asinine doctors were indiscriminately ordered to drink asses' milk. 3. JESUITICI DOCTORES, who were equally addicted to Peruvian bark; and he wittily adds, *a capite ad calcem defraudantes*. 4. AQUARII-MEDICI, whose patients were all sent to drink mineral waters. 5. LANII DOCTORES. These had recourse to the lancet in every disease. 6. STERCORARII DOCTORES. These were quite as positive in maintaining that all diseases were to be expelled by means of purging medicines. After which classification he emphatically says, *Hic autem ars medica ad instar monstri sex pedibus incedere videtur.* Had he, however, lived in these days, he must have given the beast another foot, to designate a sect of which he had no conception, namely, HYDRARGYRI DOCTORES, who attack all diseases with one and the same mercurial weapon. Or he might rather have regarded it as a monster with only one foot, of a blue colour; a true GASTEROPODE."

Journal of Royal Instit.

MODE OF FIXING FLOATING SANDS.

In a review of L. A. NECKER DE SAUSSURE *Voyage en Ecosse,* in the Journal of the Royal Institution, it is said: "On his return across the main land of Scotland, our author notices the downs, or moving sands, on the coast of the southern Murray Firth. The inhabitants, mistaken as to the cause of so formidable a phenomenon, do nothing requisite to hinder its disastrous effects. They regard these masses of sand as produced by extraordinary inundations of the sea, and by rare and accidental subversions of the soil. But it is not to so uncommon causes that we must have recourse to explain the increasing accumulation of sands on the shores of Morayshire. The constant and ordinary action of the tide, sun, and wind, is its true cause, and hence this accumulation being susceptible of indefinite increase, it becomes a matter of the first urgency to apply a remedy to it; which urgency is not sufficiently felt by the people of that country. It is obvious, that, as they cannot hinder the sea from throwing the sand on their shores, they ought simply to try to prevent the wind from carrying this sand inland. Now, there is only one method of effecting this; namely, the fixation of the downs. In order to fix in their place these hills, entirely composed of volatile grains which may be wafted by the wind, we must imitate what nature does in like cases, and clothe the surface of the downs exposed to the prevailing wind, with such creeping plants as live in the sands, and form a net-work capable of retaining the loose and light particles. An act of parliament has already prohibited the pulling of the *Arundo arenaria,* (sea mat-weed,) which grows on the downs, and serves to consolidate them. But this is not enough. We must aid nature, and by repeated sowing, multiply the existing plants, and add new species, such as *Elymus arenarius,* (sea lime-grass,) and especially the *Ulex Europæus,* or furze, called in Scotland, whins. A complete developement of the precautions to be taken in this kind of culture, is to be found in the interesting memoir of M. Desmarets on the downs of the departments of the Gironde and the Landes, which forms a part of the dictionary of physical geography in the *Encyclopédie Méthodique.* The memoir of M. Decandolle, on the fertilization of downs, inserted in the 12th volume of the *Annals of French Agriculture,* deserves also to be consulted. This learned naturalist has occupied himself not only with the problem of fixing downs; but he has also resolved the more important problem, of changing these heaps of sand into productive and fertile soils. He indicates, with this view, the kinds of plantations most suitable to sandy soils, and he enters into interesting details on the precaution indispensable to success in such undertakings. The shores of France on the Bay of Biscay present, on a greater scale, the same phenomena of advancing downs as the coast of Morayshire. The same means by which they have succeeded in arresting, on some points of these shores, the invasion of fertile fields by moving sands, the change of the beds of rivers, the formation of ponds, and finally, the burying of edifices, trees and whole villages, might undoubtedly be employed with success in Scotland."

THE SLIDE OF ALPNACH.

We copy the following paper from THE WORKS of the late JOHN PLAYFAIR, Esq., Professor of Natural Philosophy in the University of Edinburgh, and Secretary of the Royal Society of Edinburgh;—principally on account of some curious deductions which the Professor has drawn from these premises, and which are completely at variance with the theories of friction that are now generally received among Mathematicians. The period at which Mr. Playfair visited this astonishing triumph of art, was in the Spring of 1816; and, to elucidate certain particulars in his very luminous description, we have appended a few notes, from a communication on the same subject, by Professor Pictet, of Geneva, inserted in the Third Number of *the Edinburgh Philosophical Journal.*

"On the South side of Pilatus, a considerable mountain near Lucerne, are great forests of spruce fir, consisting of the finest timber, but in a situation which the height, the steepness, and the ruggedness of the ground, seemed to render inaccessible. They had rarely been visited, but by the chamois hunters, and it was from them, indeed, that the first information concerning the size of the trees and the extent of the forest appears to have been received. These woods are in the canton of Unterwalden, one of those in which the ancient spirit of the Swiss republics is the best preserved; where the manners are extremely simple, the occupations of the people mostly those of agriculture, where there are no manufactures, little accumulation of capital, and no commercial enterprize. In the possession of such masters, the lofty firs of Pilatus were likely to remain long the ornaments of their native mountain.

"A few years ago, however, Mr. Rupp, a native of Wirtemberg, and a skilful engineer, in which profession he had been educated, indignant at the political changes effected in his own country, was induced to take refuge among a free people, and came to settle in the canton of Schwytz, on the opposite side of the lake of Lucerne. The accounts which he heard there of the forest just mentioned, determined him to visit it,* and he was so much struck by its appearance, that, long and rugged as the descent was, he conceived the bold project of bringing down the trees by no other force than their own weight into the lake of Lucerne, from which the conveyance to the German Ocean was easy and expeditious. A more accurate survey of the ground convinced him of the practicability of the project.

"He had by this time resided long enough in Switzerland to have both his talents and integrity in such estimation, that he was able to prevail on a number of the proprietors to form a company, with a joint stock, to be laid out in the purchase of the forest, and in the construction of the road along which it was intended that the trees should slide down into the lake of Lucerne, an arm or gulph of which fortunately approaches quite near to the bottom of the mountain. The sum required for this purpose was very considerable for that country, amounting to nine or ten thousand pounds; three thousand to be laid out on the purchase of the forest, from the community of Alpnach, the proprietors of it, and the rest being necessary for the construction of the singular rail-way by which the trees were to be brought down. In a country where there is little enterprize, few capitalists, and where he was himself a stranger, this was not the least difficult part of Mr. Rupp's undertaking.†

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* For many centuries, the rugged flanks and the deep gorges of Mount Pilatus were covered with impenetrable forests. Lofty precipices encircled them on all sides. Even the daring hunters were scarcely able to reach them, and the inhabitants of the valley had never conceived the idea of disturbing them with the axe. These immense forests were therefore permitted to grow and to perish, without being of the least utility to man, till a foreigner, conducted into their wild recesses in pursuit of the chamois, was struck with wonder at the sight, and directed the attention of several Swiss gentlemen to the extent and superiority of the timber.

† The boldness which characterises this work, the sagacity displayed in all its arrangements, and the skill of the engineer, have excited the wonder of every person who has seen it. Before any step could be taken in its erection, it was necessary to

"The distance which the trees had to be conveyed is about three of the leagues of that country, or, more exactly, 46,000 feet. The medium height of the forest is about 25000 feet; (which measure I took from General Pfyffer's model of the Alps, and not any actual measurement of my own). The horizontal distance just mentioned, when reduced to English measure, making allowance for the Swiss foot, is 44,252 feet, eight English miles and about three furlongs. The declivity is therefore one foot in 17.68; the medium angle of elevation 3° 14′ 20″.

"This declivity, though so moderate on the whole, is, in many places, very rapid; at the beginning, the inclination is about one-fourth of a right angle, or about 22° 30′; in many places it is 20°, but nowhere greater than the angle first mentioned, 22° 30′. The inclination continues of this quantity for about 500 feet, after which the way is less steep, and often considerably circuitous, according to the directions which the ruggedness of the ground forces it to take.

"Along this line the trees descend, in a sort of trough, built in a cradle form, and extending from the forest to the edge of the lake. Three trees, squared,

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cut several thousand trees to obtain a passage through the impenetrable thickets; and as the workmen advanced, men were posted at certain distances in order to point out the road for their return, and to discover, in the gorges, the places where the piles of wood had been established. M. Rupp was himself obliged, more than once, to be suspended by cords, in order to descend precipices many hundred feet high; and in the first months of the undertaking he was attacked with a violent fever, which deprived him of the power of superintending his workmen. Nothing, however, could diminish his invincible perseverance. He was carried every day to the mountain in a barrow, to direct the labours of the workmen, which was absolutely necessary, as he had scarcely two good carpenters among them all, the rest having been hired by accident, without any of the knowledge which such an undertaking required. M. Rupp had also to contend against the prejudices of the peasantry. He was supposed to have communion with the devil. He was charged with heresy, and every obstacle was thrown in the way of an enterprize, which they regarded as absurd and impracticable. All these difficulties, however, were surmounted, and he had at last the satisfaction of observing the trees descend from the mountain with the rapidity of lightning.

and laid side by side, form the bottom of the trough; the tree in the middle having its surface hollowed, so that a rill of water received from distance to distance, over the side of the trough, may be conveyed along the bottom and preserve it moist. Adjoining to the central part, (of the trough,) other trees, also squared, are laid parallel to the former, in such a manner as to form a trough, rounded in the interior, and of such dimensions as to allow the largest trees to lie, or to move along quite readily. When the direction of the trough turns, or has any bending, of which there are many, its sides are made higher and stronger, especially on the convex side, or that from which it bends, so as to provide against the trees bolting or flying out, which they sometimes do, in spite of every precaution. In general, the trough is from five to six feet wide at top, and from three to four in depth, varying, however, in different places, according to circumstances.

" This singular road has been constructed at considerable expense; though, as it goes, almost for its whole length, through a forest, the materials of construction were at hand, and of small value. It contains, we are told, thirty thousand trees; it is, in general, supported on cross timbers, that are themselves supported by uprights fixed in the ground; and these cross timbers are sometimes close to the surface; they are occasionally under it, and sometimes elevated to a great height above it. It crosses in its way three great ravines, one at the height of 64 feet, another at the height of 103, and the third, where it goes along the face of a rock, at that of 157; in two places it is conveyed under ground. It was finished in 1812.

" The trees which descend by this conveyance are spruce firs, very straight, and of great size. All their branches are lopped off; they are stripped of the bark, and the surface, of course, made tolerably smooth. The trees, or logs, of which the trough is built, are dressed with the axe, but without much care.

" All being thus prepared, the tree is launched with the root end foremost, into the steep part of the trough, and in a few seconds acquires such a velocity as enables it to reach the lake in the short space of six minutes;[*] a result altogether astonishing, when it is considered, that the distance is more than eight miles, that the average declivity is but one foot in seventeen, and that the route which the trees have to follow is often circuitous, and in some places almost horizontal.

"Where large bodies are moved with such velocity as has now been described, and so tremendous a force of course produced, every thing had need to be done with the utmost regularity; every obstacle carefully removed that can obstruct the motion, or that might suffer by so fearful a collision. Every thing, accordingly, with regard to launching off the trees, is directed by telegraphic signals. All along the slide, men are stationed, at different distances, from half a mile to three quarters, or more, but so that every station may be seen from the next, both above and below. At each of these stations, also, is a telegraph, consisting of a large board like a door, that turns at its middle on a horizontal axle. When the board is placed upright, it is seen from the two adjacent stations; when it is turned horizontally, or rather parallel to the surface of the ground, it is invisible from both. When the tree is launched from the top, a signal is made, by turning the board upright; the same is followed by the rest, and thus the information is conveyed, almost instantaneously, all along the slide, that a tree is now on its way. By and bye, to any one that is stationed on the side, even to those at a great distance, the same is announced by the roaring of the tree itself, which becomes always louder and louder; the tree comes in sight when it is perhaps half a mile distant, and in an instant after shoots past, with the noise of thunder and the rapidity of lightning. As soon as it has reached the bottom, the lowest telegraph is turned down, the signal passes along all the stations, and the workmen at the top are informed that the tree has arrived in safety. Another is set off as expeditiously as possible; the moment is announced, as before, and the same process is repeated, till all the trees that have been got in readiness for that day have been sent down into the lake.*

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[*] The larger pines, which were about 100 feet long, and ten inches thick at their smaller extremity, ran through the space of *three leagues*, or nearly *nine miles, in two minutes and a half*, and during their descent, they appeared to be only a few feet in length.

"When a tree sticks by accident, or when it flies out, a signal is made from the nearest station, by half depressing the board, and the workmen from above and below come to assist in getting out the tree that has stuck, or correcting any thing that is wrong in the slide, from the springing of a beam in the slide; and thus the interruption to the work is rendered as short as possible.

"We saw five trees come down; the place where we stood was near the lower end, and the declivity was inconsiderable, (the bottom of the slide nearly resting on the surface,) yet the trees passed with astonishing rapidity. The greatest of them was a spruce fir a hundred feet long, four feet in diameter at the lower end, and one foot at the upper. The greatest trees are those which descend with the greatest rapidity; and the velocity as well as the roaring of this one was evidently greater than of the rest.† A tree must be very large, to descend at all in this manner; a tree, Mr. Rupp informed us, that was only half the dimensions of the preceding, and therefore only an eighth part of its weight, would not be able to make its way from the top to the bottom. One of the trees that we saw, broke by some accident into two; the lighter part stopped almost immediately, and the remaining part came to rest soon after. This is a valuable fact: it appears from it that the friction is not in proportion to the weight, but becomes relatively less as the weight increases, contrary to the opinion that is generally received.

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* The arrangements for this part of the operation were extremely simple. From the lower end of the slide to the upper end, where the trees were introduced, workmen were posted at regular distances, and as soon as every thing was ready, the workman at the lower end of the slide cried out to the one above him, "*Lachez*," (Let go.) The cry was repeated from one to another, and reached the top of the slide in *three* minutes. The workman at the top of the slide then cried out to the one before him, "*Il vient*," (It comes,) and the tree was instantly launched down the slide, preceded by the cry which was repeated from post to post. As soon as the tree had reached the bottom, and plunged into the lake, the cry of *Lachez* was repeated as before, and a new tree was launched in a similar manner. By these means a tree descended every five or six minutes, provided no accident happened to the slide.

† In order to shew the enormous force which the trees acquired from the great velocity of their descent, M. Rupp made

" In viewing the descent of the trees, my nephew and I stood quite close to the edge of the trough, not being more interested about any thing than to experience the impression which the near view of so singular an object must make on a spectator. The noise, the rapidity of the motion, the magnitude of the moving body, and the force with which it seemed to shake the trough as it passed, were altogether very formidable, and conveyed an idea of danger much greater than the reality. Our guide refused to partake of our amusement; he retreated behind a tree at some distance, where he had the consolation to be assured by Mr. Rupp, that he was no safer than we were, as a tree, when it happened to bolt from the trough, would often cut the standing trees clear over. During the whole time the slide has existed, there have been three or four fatal accidents, and one instance was the consequence of excessive temerity.

" I have mentioned that a provision was made for keeping the bottom of the trough wet; this is a very useful precaution; the friction is greatly diminished, and the swiftness is greatly increased by that means. In rainy weather the trees move much faster than in dry. We were assured, that, when the trough was every where in its most perfect condition, the weather

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arrangements for causing some of the trees to spring from the slide. They penetrated, by their thickest extremities, no less than from eighteen to twenty-four feet into the earth, and one of the trees having, by accident, struck against the other, it instantly cleft it through its whole length, as if it had been struck by lightning.

wet, and the trees very large, the descent was sometimes made in as short a time as three minutes.

"The trees thus brought down into the lake of Lucerne are formed into rafts, and floated down the very rapid stream of the Reuss, by which the lake discharges its waters first into the Aar, and then into the Rhine. By this conveyance, which is all of it in streams of great rapidity, the trees sometimes reach Basle, in a few days after they have left Lucerne; and there the immediate concern of the Alpnach company terminated. They still continue to be navigated down the Rhine in rafts to Holland, and are afloat in the German Ocean in less than a month from having descended from the side of Pilatus, a very inland mountain, not less than a thousand miles distant. The late Emperor of France had made a contract for all the timber thus brought down.*—*To be continued.*

THE BLOOD AND ITS ACTION IN THE DIFFERENT PHENOMENA OF LIFE.

Messrs. Prevost and Dumas have published in *the Bibliothèque Universelle* an interesting paper on this subject. They say, "If we submit to the action of the voltaic pile the white of an egg, it is decomposed, the coagulated albumen is carried to the positive pole, the caustic soda to the negative. This experiment, which we owe to Mr. Brande, demonstrates that the white of egg ought to be regarded as an albumenate of soda, with excess of base. We have submitted to a very careful microscopic examination, the coagulum which is produced in these circumstances, and it is not without satisfaction that we have seen very distinct globules similar in every thing to those of the blood, &c.; the same appearance, the same diameter, the same disposition to form ranges or aggregates. This remarkable result appears proper to throw some light on the animal secretions, and in particular on the formation of the chyle." They measured the dimensions of the globules of blood in different animals, by the method of Captain Kater. The following is their table of results:

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* In order that none of the small wood might be lost, M. Rupp established in the forest large manufactories of charcoal. He erected magazines for preserving it when manufactured, and had made arrangements for the construction of barrels for the purpose of carrying it to the market. In winter, when the slide was covered with snow, the barrels were made to descend on a kind of sledges. The wood which was not fit for being carbonized, was heaped up and burnt, and the ashes packed up and carried away during the winter.

A few days before Professor Pictet visited the slide, an Inspector of the Navy had come for the purpose of examining the quality of the timber. He declared that he had never seen any timber that was so strong, so fine, and of such a size, and he concluded an advantageous bargain for 1000 trees.

Such is a brief account of a work undertaken and executed by a single individual, and which has excited a very high degree of interest in every part of Europe. We regret to add, that this magnificent structure no longer exists, and that scarcely a trace of it is to be seen upon the flanks of Mount Pilatus. Political circumstances having taken away the principal source of the demand for timber, and no other market having been found, the operation of cutting and transporting the trees necessarily ceased. The money, we understand, which was paid for the Forest, has been employed in building at Alpnach a church, in every respect disproportioned to the population and resources of the village.

Diam. of a glob. of blood in	Man . .	$\frac{1}{3750}$ of an English Inch
	Dog . .	do.
	Rabbit .	do.
	Ass . . .	$\frac{1}{4173}$
	Cat . . .	$\frac{1}{4273}$
	Sheep .	$\frac{1}{5000}$
	Horse .	do.
	She goat	$\frac{1}{7200}$

According to Sir E. Home and Captain Kater, the mean dimension of the human globule is only $\frac{1}{5000}$ of an inch, which agrees perfectly with the determinations obtained by Dr. Wollaston with his most ingenious micrometer, described in the *Philosophical Transactions for* 1813. Dr. Young, by the employment of his eriometer, has also furnished various measures which may be depended on. The following are extracted from his *Introduction to Medical Literature*, published in 1813:

Diam. of a glob. of the blood of the calf	$\frac{1}{6000}$ of an in.
— Human blood diluted with water . .	$\frac{1}{5000}$
— Human blood, after being several days in water.	$\frac{1}{3000}$
— Blood of the mouse	[illegible]
— Blood of the thornback	$\frac{1}{1900}$

We thus perceive that the measurements of the foreign observers are, probably, all too high rated. But the most remarkable result which they have arrived at, is, that, while the globules are circular in all the mammiferæ, varying only in size from one animal to another; they are elliptical in birds, and vary little in size, the variation being only in the greater axis. They are also elliptical in all animals with cold blood. Another very curious fact is, that the colourless globule which exists in the centre of the particles of blood has exactly the same diameter ($\frac{1}{7500}$) of an inch, whatever be the form of the particle and the animal to which it belongs. In conclusion of their memoir we find some interesting remarks on the transfusion of blood. They bled animals to *syncope*, so that when left alone, or when water or serum of blood at 100° Fahr. was injected into their veins, they died. Into others, exhausted by a similar hæmorrhagy, when they injected the blood of an animal of the same species, every portion of the blood thrown in, re-animated perceptibly this kind of corpse; and they found, not without astonishment, that after restoring to it a quantity equal to what it had lost, it began to respire freely, to move with ease, to take nourishment, and to be restored to perfect health, when the operation was properly conducted.

If we take the blood to be injected from an animal of a different species, but whose globules have the same form, although of different dimensions, the animal is but imperfectly relieved, and can rarely be kept alive for more than six days. The pulse becomes quicker, the breathing preserves its regular state, but the animal heat falls with a remarkable rapidity when it is not artificially kept up. From the instant of the operation the stools become mucous and bloody, and preserve this character till death. If we inject blood with circular globules into a bird, the animal usually dies in the midst of very violent nervous affections, which may be compared in rapidity, to those caused by the most intense poisons. They are manifested even when the subject on which we operate, has not been enfeebled by any notable loss of blood.

The blood of the cow and the sheep was transfused into cats and rabbits. Whether the operation was practised immediately after the extraction of the blood, or whether this was left at rest in a cool place for 12 or even 24 hours, the animal has been restored for some days, in a great number of cases. The blood was kept in a fluid state, either by eliminating a certain quantity of fibrine, or by adding 0.001 of caustic soda. The blood of the sheep excites in ducks rapid and powerful convulsions, followed by death. They have frequently seen a bird die before they had completely emptied the first syringe, although it had experienced but a slight blood-letting before, and although it was in vigorous health. They consider transfusion in man to be absurd and dangerous, till we be further advanced in the intimate knowledge of the active principle of the blood.

BARLOW ON MAGNETIC ATTRACTION.

Mr. Barlow of the Royal Military Academy, in the prosecution of the magnetical experiments in which he has been for some time engaged, has discovered another curious property, which deserves to be recorded.

The first object of these experiments appears to have been to determine the relative magnetic power of different kinds of iron and steel on the needle, and his results, as connected with this determination, are as follows, viz.

	Pro. Power.		Pro. Power.
Malleable Iron, -	100	Shear Steel, soft, -	66
Cast-Steel, soft, -	74	Ditto, hard, -	53
Blistered Steel, soft,	67	Blistered Steel, hard,	53
Cast-Steel, hard, -	49	Cast-Iron, - -	84

That is, the above numbers express the relative powers of these different metals in deflecting a magnetised needle from its natural direction. Seeing that the hardest iron and steel had the least power, Mr. Barlow was next desirous of ascertaining what this comparative power might be, when heated in a furnace, and while each of the different specimens was thus rendered soft.

The results in these experiments are not so uniform as in the preceding. It is remarkable, however, that *the malleable iron, which has by far the greatest power when cold*, has the *least of any when heated;* and that the *cast-iron, which is the least powerful when cold, is the strongest when hot;* the increase of strength in the latter case being nearly as 3 to 1.

It was while pursuing these experiments with Mr. Charles Bonnycastle, that the singular effect to which we have alluded presented itself. It was observed by both these gentlemen, that between the *white heat* of the iron (when every species of magnetic attraction disappears), and the blood-red heat (when the power manifests itself so strongly), there was an intermediate action, while the iron passed through the shades of bright red and red, which attracted the needle the *contrary way* to that when cold, or at the blood-red heat; that is, if the iron and compass are so posited that the north end of the needle is attracted towards the iron when cold, the *south* end will be attracted when the iron is red hot, and *vice versa;* but as the red changes to the darkest shades of blood-red, the usual power of the iron commences, and the needle is deflected the contrary way. Moreover this *negative attraction is least in those positions where the natural cold attraction is the greatest, and greatest where the latter is the least, and greatest of all in that position where the cold attraction is zero;* that is, in the plane of no attraction, provided (of course) the needle is sufficiently near to the bar. The bars used in these experiments were 25 inches in length, 1¼ inch square, inclined in the direction of the dipping-needle; the distance varying from 5 to 9 inches; but the nearer to the bar, the more obvious are the effects. In some of the experiments referred to above, the quantity of the negative attraction exceeded 50°.—*Edin. Phil. Journal.*

DISTRIBUTION OF PLANTS.

In a very interesting paper which Baron HUMBOLDT has written *On the laws which are observed in the Dis-*

tribution of Vegetable Forms, he observes: "There exists, under the tropics, a very remarkable difference between America, India, and the west coasts of Africa. The distribution of organic beings on the globe, depends not only on very complicated climatic circumstances, but also on geological causes, with which we are entirely unacquainted, because they are connected with the original state of our planet. The great Pachydermata are wanting at the present day in the New World, although we find them still in abundance in analogous climates, in Africa, and in Asia. In the equinoctial zone of Africa, the family of palms is far from numerous, compared with the great number of species of equinoctial America. These differences, far from deterring us from the scrutiny of the laws of nature, ought to excite us to study these laws in all their complications.

"The geography of plants may be considered as a part of the natural history of the globe. If the laws which nature has followed in the distribution of vegetable forms, should prove to be more complicated than they appear at first sight, still, we ought not on this account to be deterred from submitting them to accurate investigation.. We do not relinquish the tracing of a map, when we perceive the sinuosities of rivers, and the irregular form of coasts. The laws of magnetism become intelligible to him who has commenced with tracing the lines of equal inclination and declination, and who has compared a great number of observations, which, at first sight, might appear contradictory. He who thinks that it is not yet time to search the *numerical elements* of the geography of plants, forgets the progressive march by which the physical sciences have elevated themselves to determinate results. In examining a complicated phenomenon, we commence with a general scrutiny of the circumstances by which it is determined or modified; but, before discovering certain proportions, we find, that the first results to which we attend, are not sufficiently free from local influence: it is then that we modify and correct the numerical elements, and discover the regularity in the very effects of partial disturbances. Criticism exercises self on whatever has been prematurely announced as a general result; and the spirit of criticism, once excited, becomes favourable to the investigation of truth, and accelerates the progress of human knowledge."

ANSWERS

TO THE

QUESTIONS FOR YOUTH,

Proposed in the First Number of the Fourth Volume.

(1) *By* Master *R. Hattersley.*

Given $\surd(a^2 - x^2) + x\surd(a^2 - 1) = a^2\surd(1 - x^2)$ to find x.

By R. Spofforth, J. J. *and the Proposer.*

First $x\surd(a^2 - 1) = a^2\surd(1 - x^2) - \surd(a^2 - x^2)$; squaring both sides, $a^2x^2 - x^4 = a^4(1 - x^2) - 2a^2\surd[(1-x^2).(a^2-x^2)] + a^2 - x^2$, or $2\surd[(1-x^2).(a^2-x^2)] = (a^2 + 1).(1 - x^2)$; which, being divided by $\surd(1 - x^2)$, gives $2\surd(a^2 - x^2) = (a^2 + 1)\surd(1 - x^2)$, or $x^2(a^2 + 1)^2 - 4x^2 = (a^2 + 1)^2 - 4a^2$; that is, $x = \surd\left[\frac{(a^2+1)^2 - 4a^2}{(a^2+1)^2 - 4}\right]$.—Answer

*** The answer to this question in Bonnycastle's Algebra, 10th Edition, is $\left[\frac{a^2 - 1}{a^2 + 3}\right]$, which is evidently wrong.

(2) *By* Master *Samuel Simpson.*

Theer men having bought a Cheshire cheese 18 inches in diameter, want to divide it into three equal parts by two parallel chords. Required the heights of the 3 parts, so that each person may have his proper share.

By Masters T. Graham, J. Melson, *and* J. Horner.

.7854 ÷ 3 = .2618 tab. area, the corresponding versed sine is .367534, and, by similar figures, as 1 : .367534 :: 18 : 6.615612, height of one of the ends; the double of which subtracted from 18, the diameter, gives 4.768776 = height of the middle part.—Ans.

By Master RALPH SPOFFORTH.

Dividing .785398 by 3, we get .261799, the number belonging to which in a Table of Circular Segments is .367534: hence, the height of the first and last portions is .367534 × 18 = 6.615612, and of the middle portion 18 — 2 × 6.615612 = 4.768776 inches, as was required.

(3) *By* Master *HILDYARD LEPPINGTON.*

Find the cube root of $\sqrt{(3\sqrt{5})}$ true to 6 places of decimals.

By Master JOSEPH CLIFF.

Here the cube root of $\sqrt{3\sqrt{5}} = \sqrt[12]{45}$; then the log. of 45 = 1.6532125, which, divided by 12, gives .1377677, the log. of which = 1.373307, which was required.

(4) *By* Master *T. HAIGH.*

Find the area of a circular zone, whose greater chord AB is 100, less chord DC 75, and the nearest distance of their extremities AD equal 80.

By Masters W. TILLOTSON, T. GEE, *and* T. HAIGH.

First, $\left\{80^2 - \left[\frac{100 - 75}{2}\right]^2\right\} = 6243.75 =$ the square of the zone's breadth, and (Prob. 16, p. 99, Bonnycastle's Mensuration, 12th Edition,) $6243.75 + \frac{100^2 + 75^2}{2} + \frac{(100^2 - 75^2)^2}{16 \times 6243.75} = 14247.84785 =$ the square of the diameter; which, multiplied by .7854, gives 11190.2597, the area required.

(5) *By* Master *R. PATTISON.*

If a globe of lead, whose superficies and solidity are both expressed by the same number, be let fall into an hemispherical bowl 12 Inches in diameter, filled with water, how much water will run over?

By Master R. Spofforth.

The diameter of a globe whose solidity and superficies are expressed by the same number, is 6; and as the hemispherical bowl is as large again in diameter as the globe, the latter will be just immersed, and expel half the water, or $6^3 \times .5236 = 113.0976$ cubic inches from the bowl.

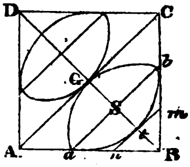
By Masters J. Horner, W. Tillotson, *and* J. Deakins.

Let $x =$ the diameter; then, by Mensuration and the question, $.5236x^3 \doteq 3.1416x^2$, or $x = 6$: therefore, the solidity $= 113.0976$, which will be the quantity of water expelled.

(6) *By* Master *J. Laycock.*

A jeweller having a piece of tortoise-shell 8 inches square, wishes to cut two equal ellipses out of it the greatest possible; but the poor fellow being as ignorant of geometry as the man in the moon, requests that some of your young Tyros will have the goodness to inform him what will be their principal diameters.

By Masters J. Turton, W. Coultas, J. Deakins, S. Simpson, W. Oakes, *and* J. Laycock.



Let ABCD represent the square, AC one of its diagonals; then, by what has been done in a former Number of the Correspondent, the sides are bisected in the points of contact when the ellipses are the greatest possible. Let *ab* $=$ transverse diameter, *mn* be a tangent at *t*, parallel to *ab*; then, by Conic Sections, $ab = \surd(\text{AC} \times mn) = \surd\frac{1}{3}\text{AC}^2 = 6.531972$, the transverse diameter, and the conjugate diameter $= \frac{2}{3}\text{BG} = \frac{2}{3} \times (\text{AC} \div 2) = \frac{1}{3}\text{AC} \doteq 3.771236$ inches.

By Master W. Tillotson.

The ellipses will be the greatest when they are inscribed in the triangles formed by the diagonal and the sides of the square, so as to bisect the sides. Put $a = 4\sqrt{2}$ = the semi-diagonal, and $2x$ = the conjugate diameter; then, (by Schol. to Theor. 3, chap. 2, sec. 1, Hutton's Course, Vol. 3, and the nature of the elliptic tangent,) $\frac{a}{2} - x : x :: x : a - x$. Hence, $2x = \frac{2a}{3} = \frac{8}{3}\sqrt{2} = 3.7712363$ inches, the conjugate diameter; and $\sqrt{\left(\frac{a}{2} \times \frac{a}{6}\right)} : \frac{a}{2} :: \frac{2a}{3} : \frac{2a}{3}\sqrt{3} = \frac{8}{3}\sqrt{6} = 6.5319725$ = the transverse, as was required.

(7) *By* Master *J. Deakins.*

A hexagon of fertile soil,
Whose boundary was just one mile,
Was let unto a quaker,
Who 30 years did pay no rent.
What will be due at 5 per cent,
And just 2 pounds per acre?

By Master W. R. Bennett.

Here, $5280 \div 6 = 880$ feet = side of the hexagon, and its area 2011950.20928 feet, or 46.18802133 + &c. acres; which, at £2. per acre, = £92. 7*s.* 6¼*d.*, which, being forborne 30 years, at 5 per cent., amounts to £6137. 7*s.* 1¾*d.* nearly.

By Master F. Foster.

Here, $1760 \div 6 = 293.3$. Then, $(293.3^2 \times 2.598076) \div 4840 = 46.187965208 \times 2 =$ £92.3759 = £92. 7*s.* 6*d.* the yearly rent; and, by Walkingham, $[(92.3759 \times 30^2 - 92.3759 \times 30) \div 2] \times .05 + 92.3759 \times 30 =$ £4780.4528325, Simple Interest.

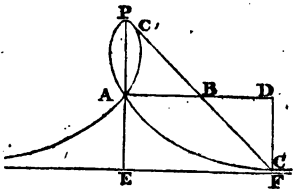
Again, taking £66.43884, the amount of one pound for 30 years, and multiplying by £92.37593, we have £6137.3496, at Compound Interest.

(8) *By* Master *C. Bartholomew.*

P is a given point and AB a straight line given in position. Draw PA perpendicular to AB, and draw any straight line

PBC cutting AB in B, and take BC always equal to AB; required the equation of the curve in which the point C moves.

By Mr. W. Tillotson, *and the Proposer.*



Put AP $= a$, AD $= x$, and DC $= y$; then, the triangles APB, BCD being similar, AP : DC :: AB : BD; *et, componendo*, AP + DC : AD :: AP : AB $= \frac{ax}{a+x}$ :: DC : BD $= \frac{xy}{a+y}$. But BD² + DC² = BC² = AB², that is $\frac{x^2y^2}{(a+y)^2} + y^2 = \frac{a^2x^2}{(a+y)^2}$; hence $x = y\surd[(a+y) \div (a-y)]$, the equation of the curve. When $y = 0$, $\pm x = 0$, and the curve passes twice through A; when $y = \pm a$, x is infinite or 0: Therefore the curve approaches the asymptote EF drawn parallel to AD at the distance AE = AP from it, and passes through P, having a *punctum duplex* at A and a *nodus* between A and P.

◆

Ingenious solutions to all the questions in the Juvenile Department were transmitted by Masters Francis Foster, Belle-Vue Academy, Armley; R. Spofforth and W. Tillotson, Rev. Dr. Inohbald's, Bawtry; Joseph Cliffe, Armley; Richard Hattersley and Ant. Shearwin, Chapelthorpe, near Wakefield; John Macauley, Liverpool; and Jonathan Horner, Knaresbro'.

W. R. Bennett, Plymouth Dock, answered 1, 2, 4, 5, 6, 7.

John Deakins answered 2, 3, 4, 5, 6, 7, 8; S. Simpson, 4, 5, 6, 7; R. Pattison and Josiah Turton, 2, 3, 4, 6; W. Oakes, 2, 3, 6; T. Graham, 2, 3, 4, and J. Melson, 2;—all of Woodhouse Grove Seminary, near Bradford, Yorkshire.

William Pitt, Godsworthy, near Ackworth, and W. Jackson, Doncaster, answered 2, 3, 5, 7.

J. J. of Wakefield, answered 1, 2, 4.

◆

ANSWERS
TO THE
MATHEMATICAL QUESTIONS

Proposed in the First Number of the Fourth Volume.

◆

Six numbers of the Leeds Correspondent are now, and will be hereafter, regularly offered as a prize, to be adjudged BY LOT, to one Gentleman out of those who may give true solutions to the Prize Question in each number.

Amicus, being the only person who has answered the Prize Question in this Number, will have the goodness to apply, either personally or by letter, to Mr. John Heaton, Bookseller, Briggate, Leeds, and he will receive six copies of this Number gratuitously, as allotted to him.

◆

(251) *By* Mr. ROBERT SMITH, *Manchester.*

A and B toss together with a halfpenny for a wager at what is called "New market:" what are the odds in favour of either A or B winning two tosses successively out of three?

By the Rev. B. BRONWIN.

What *tossing at Newmarket* is, I confess I do not exactly know; but, from the question, it appears to consist in one of these two things:—Either A and B toss each three times to bring up a particular face, a head for instance; or the face the other names;—or they toss only three times between them, the one tossing, and the other naming the particular face.

In the first case, the number of ways in which three half-pence, taken in the order 1, 2, 3, can fall, is 8. And of these there are three in which the person tossing may win. A's chance, therefore, of two successive heads in three tosses is $\frac{3}{8}$; his chance of failing $\frac{5}{8}$; the probability of both A and B failing $\frac{5}{8} \times \frac{5}{8} = \frac{25}{64}$; and the chance of one of them at least winning is $1 - \frac{25}{64} = \frac{39}{64}$. The odds, therefore, in their favour are as 39 to 25.

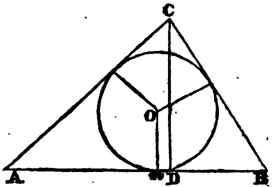
In the second case, the chances of winning and losing at each toss are precisely the same as if a head was always required to be thrown, as is evident. Now, in this case, there are three ways in which A may win, three in which B may win, two in which neither of them can win, and six in which one or the other of them must win. The probability, therefore, is $\frac{6}{8}$ or $\frac{3}{4}$; and the odds in their favour, as 3 to 1.—But I rather presume the former case to be intended by the proposer.

Solutions to this question were given by Messrs. Baines, Bartholomew, Jerwood, Hattersley, Marsh, Shepherd, and Smith, the proposer.

(252) *By* Mr. William Stringer.

Given the segments of the Base made by the perpendicular 84 and 66, and the Ratio of the perpendicular to the Radius of the inscribed circle as 14 to 5, to determine the triangle.

By the Rev. B. Bronwin.



Let P denote the perimiter. Then (see the annexed figure,) we have $om \,.\, P = AB \,.\, CD$; and, consequently, $om : CD :: AB : P$; which is therefore given, because $om : CD$ is a given ratio, and AB is given in magnitude. Also $AC + BC = P - AB$ is given. But by a well-known property of triangles, $AC + BC : AB$

:: AD — BD : AC — BC. This last is therefore known; and, consequently, AC and BC are each known.

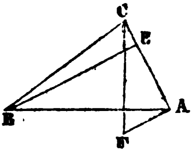
The numerical computation, which is too obvious to need explanation, gives AB = 150, AC = 140, and BC = 130.

Ingenious solutions were given by Messrs. Baines, Bartholomew, Hattersley, Jerwood, Godward, Stringer, Shepherd, and Marsh.

(253) *By* Mr. William Godward.

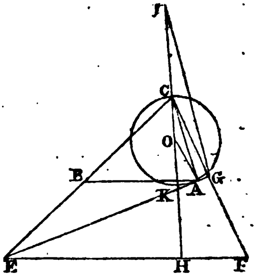
Given the sum of the two sides AC and BC and their included angle, to construct the plane triangle so, that when it is placed in a vertical plane with the side AB parallel to the horizon, a heavy body may descend down AC in the least time possible.

By Plus Minus.



Draw EB, AF perpendicular to AC, and CF to AB. When the time down AC is a maximum or minimum, its equal (the time down CF) is so too, and consequently CF, or its square, is a maximum or minimum.

Put BC + AC = S, n = sine and m = co-sine of the ∠ BCA, and BC = x; then AC = S — x, BE = nx, CE = mx, and AE = S — x — mx = S — rx (putting $r = 1 + m$). Hence (Euc. 47, 1.) $AB^2 = (S - rx)^2 + n^2r^2$; then, by similar triangles, $BE^2 : AB^2 :: AC^2 : CF^2 = (S - x)^2 . [(S - rx)^2 + n^2x^2] \div n^2x^2$ = a maximum or minimum. Put the fluxion of its logarithm = 0, and we get, by reduction, $\frac{x(r^2 + n^2) - rs}{(S - rx)^2 + n^2x^2} = \frac{S}{Sx - x^2}$, an equation indicating that the problem is naturally solid, or not solvible by plane geometry. But, if the sum of the sides AB and BC had been given, which was probably intended by the proposer, the problem might have been constructed geometrically, as follows:—



Constr.—Take EF equal to the given sum, and draw EC = EF, making CEF = to the given angle; join CF; draw EG perp. to CF, and CH to EF; in CH produced take CI = CG, and parallel to IG joined, draw CA cutting EG in A; draw AB parallel to EF, meeting EC in B, and ABC is the △ required.

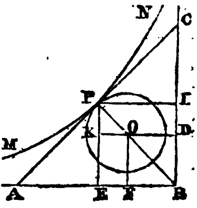
Dem.—Draw AO perpendicular to EG, or parallel to CG, meeting CH in O. Since IG is parallel to AC, and CG to AO, the triangles CIG, OCA are similar; and because CG = CI, therefore AO = OC or a circle to centre O, and radius OA will pass through C and touch EG at A, because EAO is a right angle: this circle, then, is a minimum, and of course the time down its vertical diameter CK, or its equal, (the time down CA,) is a minimum. Now, because the triangle FEC is isosceles, the perpendicular EG will bisect the ∠ FEC, or ∠ AEB = AEF = (by parallels,) ∠ EAB: therefore, BE = BA, or BA + BC = EC, the given sum; and CBA is equal to CEF, the given angle by the construction.—Q.E.D.

Ingenious solutions were received from Messrs. Baines, Bronwin, Hattersley, Shepherd, Godward, and Stringer.

(254) *By* Mr. J. Baines, *Doncaster.*

Given the three perpendiculars let fall from a point within a right angled triangle upon the three sides, to construct it when the area is a minimum.

By Solidus.



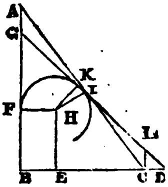
Constr.—With two of the given perpendiculars OF, OD, form the rectangle OFBD, and about the centre O, with the radius OP, = to the other given perpendicular, describe a circle; then, to the asymptotes BF, BD, describe the equilateral hyperbola MPN to touch the circle in P, through which point draw AC perpendicular to OP, meeting the asymptotes in A, C, and ABC is the required △.

DEM.—For OP, OF, OD are the given perpendiculars by the Construction, and AC is a common tangent to the two curves at P; therefore, by the property of the hyperbola, AP = PC, and (by Simpson on the Max. et Min.,) the triangle ABC is a minimum.

The same Algebraically.

Draw PI parallel and PE perpendicular to AB, the latter meeting OD produced in K. Put $r = \text{PO}$, $\text{OD} = a$, $\text{OF} = b$, and $\text{OK} = x$: then $\text{PK} = \surd(r^2 - x^2)$, $\text{PI} = a + x$, $\text{PE} = b + \surd(r^2 - x^2)$. The right angled triangles OKP, PIC, PEA being similar, we have PO : OK :: PA : PE, and PK : PO :: PI : PC (PA): whence, compoundedly, PK : OK :: PI : PE, or PK . PE = OK . PI; i. e., in symbols, $\surd(r^2 - x^2) \times [b + \surd(r^2 - x^2)] = x \times (a + x)$. Hence $(2x^2 + ax - r^2)^2 \div (r^2 - x^2) = b^2$, an equation of the fourth order: from which we infer, that the problem cannot be constructed geometrically, by right lines and the circle, except it be in some particular cases of the values of a, b, c. If $a = b$, we should have $x = r\surd\frac{1}{2}$, which shews, that, in this case, the right line BP bisecting the angle B, determines, where it intersects the circle, the point P, and consequently the △ ABC.

By the Proposer.



Let ABC be the required triangle; HE, HF, HI the perpendiculars, let fall from the point H upon the sides BC, BA, AC; then, the triangle ACB will be a minimum when the perpendicular HI bisects the hypothenuse AC in I: for, if not, suppose BGD to be a minimum, HK = HI = the perpendicular; then, if K fall above I, GK is less than AI. Draw CL parallel to AB; then, because the triangles AGK, CLK are similar, their areas are proportional to AG . AK, CL . CK; but CK is greater than AK, and CL than AG: therefore △ CLK is greater than AGK. Hence, the trapezoid CBGL is greater than the △ ABC; much more, then, is the △ GBD greater than ABC. In the same manner, it may be proved, if K be taken below I, that the △ ABC is less than any other triangle which has the perpendicular falling on the hypothenuse below the point I: therefore ABC is the least.

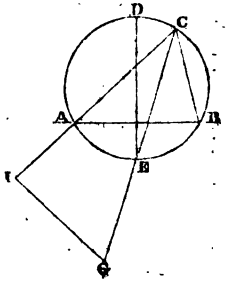
Put $BE = FH = a$, $HE = FB = b$, $HI = c$, and $EC = x$; then $BC = a + x$, $CH^2 = AH^2 = b^2 + x^2$, $CI^2 = IA^2 = b^2 - c^2 + x^2$, $AF = \sqrt{(b^2 - a^2 + x^2)}$, and $AB = b + \sqrt{(b^2 - a^2 + x^2)}$; but $AB^2 + BC^2 = 4CI^2$; that is, $b^2 + 2b\sqrt{(b^2 - a^2 + x^2)} + b^2 - a^2 + x^2 + a^2 + 2ax + x^2 = 4b^2 - 4c^2 + 4x^2$, or $x^4 - 2ax^3 + (a^2 + b^2 - 4c^2)x^2 + (4ac^2 - 2ab^2)x + a^2b^2 - 4b^2c^2 + 4c^4 = 0$, a biquadratic equation, and the absolute term having no common factor, it admits not of being reduced to lower dimensions, and therefore the problem is not solvible by plane geometry.

Messrs. Bronwin, Bartholomew, Jerwood, Hattersley, Stringer, and Shepherd sent solutions to this question.

(255) *By* Mr. W. Wright, *Stationer, Hull.*

Given the vertical angle, the rectangle under the base and perimeter, to construct the plane triangle when the sum of the diameters of the circumscribing circle, and the circle touching the base and prolongation of the sides, is given, or a minimum.

By Messrs. Stringer *and* Shepherd.



Analysis.—Imagine ACB to be the △ required, ADBE its circumscribing circle, whose diameter DE is perpendicular to AB; join CE, and continue it to G, the centre of the circle touching the base and prolongation of the sides, and demit GI perpendicular to CA produced in I. Then, because the ∠ ACB is given, the ratio of DE : AB is given, and the ratio of 2IG : IC is given. But DE + 2IG is given: therefore AB, together with a line that has a given ratio to IC, is given; and, by the question, AB, 2IC is given. Therefore, the rectangle of AB and the line that has the given ratio to IC is given: consequently, there are given, the sum and rectangle of two lines, to determine them. Whence, IC is given, and, consequently, AB is given and the Construction manifest.

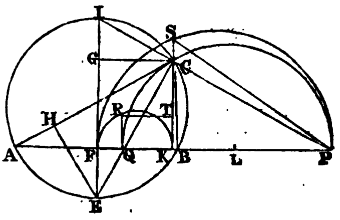
When DE + 2IG is a minimum, AB, together with a line that has a given ratio to IC, is a minimum; and DE . 2IC, or the rectangle of AB and the line that has the given ratio to IC, is given: therefore, AB is = to the line that has the given ratio to IC: consequently AB^2, or AB, is given, and the Construction manifest.

In this manner, nearly, the solution is given by Messrs. Baines, Bronwin, and Wright the proposer.

(256) *By* Mr. J. H. SWALE.

Given the sum of the sides and the difference of the segments of the base, by the perpendicular, to determine the triangle, when the area is given, or a maximum.

By GEOMETRICUS, *and* Mr. W. SHEPHERD, *Bradford.*

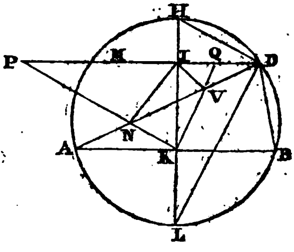


ANALYSIS. Suppose the required triangle, ACB, circumscribed by a circle, of which the diameter IE cuts the base AB in F at right angles. Draw CK perpendicular to AB, CG to IE, and EH to AC; and let AB meet CE in Q and IC in P; then, by similar triangles, GC : GE :: IF : FP. Therefore GC . FP = GE . IF = (by a known property in the STUDENT,) CH^2; but GC = FK, half the difference of the segments AK, KB, and CH = half the sum of the sides AC,CB, are given: therefore FP is given. Now, the triangles QFE, QKC, PKC, and PFI being equiangular, we have $FQ \cdot FP = IF \cdot FE =$ (by the circle) FB^2, also $PK \cdot KQ = KC^2$: therefore $FP \cdot PK \cdot FQ \cdot QK = FB^2 \cdot KC^2$. Describe, on the given diameters FK, FP, two semi-circles cutting QR, KS, perpendiculars to FP, in R, S; then the lines FSP and KS being given in position, the point S is given, and P being also a given point, the straight line PS is given in magnitude.

But, by the circle, $PS^2 = FP \cdot PK$, and $QR^2 = FQ \cdot QK$: therefore $PS^2 \cdot QR^2 = FB^2 \cdot KC^2$, or $PS \cdot QR = FB \cdot KC$; but the rectangle $FB \cdot KC$, equal to the area of the triangle ABC, is given: therefore $PS \cdot QR$ is equal to the given area, and because PS is given, QR is given. Take, in KS, KT equal QR; then T will be a given point, and TR drawn parallel to FK determines the point R, and consequently the required triangle ACB.

The Composition follows so obviously from the Analysis, that we shall, for the sake of brevity, omit it. Because the right line TR must either cut or touch the semi-circle on FK, when the problem is possible, it is evident that the general problem admits of two solutions; but, in the particular case of the maximum, TR will touch the semi-circle at R on $KT = RT = \frac{1}{2}FK$: whence the maximum area $= \frac{1}{2}FK \cdot PS$, and the square of FB equals half the square of CH, or $AB^2 = \frac{1}{2} \cdot (AC + BC)^2$.

By the Proposer.



Suppose ADB, the required triangle, circumscribed by the ○AHDBL; the diameter HL bisecting the base AB at K. Join D,H; D,L; and draw DI, KQ, KP parallel to the lines BA, LD, DH, respectively. Then, DA + DB (2DM) and 2DI, or

DM and DI, are given; and the rectangle IK . KB, or $IK^2 . KB^2$, is given, or a maximum. Now, $DM^2 = HK . IL$ and $DI^2 = HI . IL$, or HK . IL and HI . IL, are given rectangles; and, thence, HK : HI, equal DP : DI, (per the parallels DH, KP,) is a given ratio, or DP, IP, given.

Again, the angle PKQ is obviously a right angle, or $IK^2 = PI . IQ$; and, per the circle, $KB^2 = HK . KL$. Hence, PI . IQ . HK . KL, or IQ . HK . KL, or IK . IQ . KL, or LK . IK . QD, or $IK^2 . QD$, or PI . IQ . QD, or IQ . QD, is given, or a maximum: (For the ratio KH : KI is given; and, because of the parallels DL, QK, we have IQ : QD = IK : KL, or IQ . KL = IK . QD.) Whence, our problem is only, To divide a given line into two parts, of which the rectangle shall be given, or a maximum..

Instead of the Composition of this extremely easy problem, we add the following general properties of the figure:

Let KQ, KP intersect AD at V, N. Then,

1. $DP . DI = AV^2$ or DN^2.
2. $DQ . DI = DV^2$ or AN^2.
3. VN = DB.
4. Lines drawn from I, making, with IK, ID, the angles KIN, DIV each equal to half the angle ADB, shall pass through the points N, V, and be perpendicular to each other.

5 In the figure for the maximum case, where DQ = QI, a circle through H, I, B will touch KB at B.

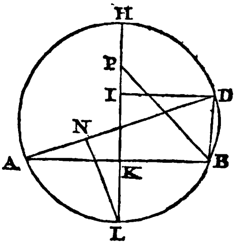
6. $DM^2 = 2KB^2$ and $DV^2 = 2DQ^2$.

7. Hence, when the sum of the sides, and the difference of the segments of the base, are given, the triangle will be the greatest, when the square of the base is equal to twice the square of half the sum of the sides. Or,

8. When the square of the difference of the sides is equal to twice the square of half the difference of the segments of the base.

The Comps. for the max., derived from the 7th and 8th, will be extremely simple and elegant.

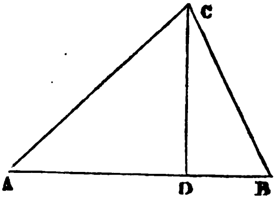
Otherwise, by the same.



Suppose the required triangle ADB determined, and circumscribed by the circle AHBL; the diameter HL bisecting the base AB at K. Draw DI, LN at right angles to HL,DA; and apply to LH the line BP = DN. Then, 2DN, 2DI, or DN, DI, are given lines; and, by known properties, HK . IL = DN², and HI . IL = ID²: Or, HK . IL, a given rectangle, HK : KI a given ratio, and the rectangle KI.KB given, or a maximum. Now, HK . IL = HK . KL + HK . KI = KB² + HK . KI = DN² = BP² = KB² + KP² Then, HK . KI = KP²; and HK : KI = HK . KI : KI² = KP² : KI², or KP : KI, a given ratio. Hence, BP is given, and the rectangle KP . KB given, or a maximum. That is, To determine the right angled triangle, we have given, the hypothenuse and the rectangle of the legs. In which problem, the Comps. for KB . KP = a given space, and KB . KP a maximum, are equally simple and well-known.

This problem forms No. 386 of Professor Leybourn's Data: having been proposed and solved by Mr. Wildbore, as Question 72, Dr. Hutton's Miscellanea Mathematica.

By the Rev. B. Bronwin.



Put $a = \frac{1}{2}(AC + BC)$, $d = \frac{1}{2}(AD - DB)$, and $x = \frac{1}{2}AB$. Then, by a well-known property, $a : x :: d : \frac{d}{a}x = \frac{1}{2}(AC - BC)$. Whence $AC = a + \frac{d}{a}x$, $BC = A - \frac{d}{a}x$, and $\frac{1}{4}AB^2 . CD^2 = \left\{ \left[a + \frac{d}{a}x\right]^2 - (d+x)^2 \right\} \times x^2 = (x^4 - a^2x^2) . \left(\frac{d^2 - a^2}{a^2}\right)$, which is a maximum, or given. Its fluxion put $= 0$, gives $x = \frac{a}{\sqrt{2}}$.

For the 2d case, put $x^4 - a^2x^2 = m^2$, and we have $x = \sqrt{\left\{\frac{a}{2} + \sqrt{\left[m^2 + \frac{a^2}{4}\right]}\right\}}$; whence all the rest in each case may be readily found.

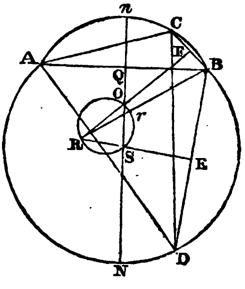
From the preceding solution it appears, that the geometrical construction, in both cases, is easily effected.

Fluxional solutions were transmitted by Messrs. Baines, Jerwood, and Hattersley. Mr. Stringer solved it by the intersection of the hyperbola and ellipsis.

(257) *By the same.*

Given all the angles and one of the diagonals, to determine the trapezium, when the other diagonal is a maximum or a minimum.

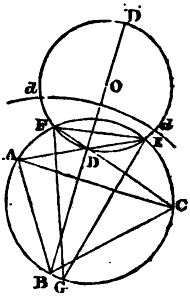
The ANALYSIS,—*by* NOV-ANGLUS, *and* Mr. STRINGER.



Suppose ACBD the required trapezium. Describe on AB, the given diagonal, two segments of circles to contain the given angles ACB, ADB; then the centres (O, S) of these circles will be given points in the perpendicular QN, erected upon the middle of AB; and ER, FR, perpendiculars to BD, BC, at their middle points E, F, will pass through the respective centres S, O, the point of concourse R being the centre of the circle circumscribing the triangle CBD; and because of the right angles at E, F, the angle FRE, or ORS, is the supplement of FBE or of CBD; therefore the angle ORS is given, and because OS is given, the locus of the point R is a given circle. But in consequence of the given angle CBD, the ratio of RB, the radius of the circle passing through C,B,D to

DC, the variable diagonal, is given: therefore, when DC is a maximum or a minimum, RB is so too. But RB is a maximum or minimum (Euc. 8, 3.) when it passes through the centre of the circle *oRsr;* and because that centre and the point B are given in position, the straight line RB is given in position and magnitude. Hence the construction is evident.

The Composition,—*by* Geometricus.



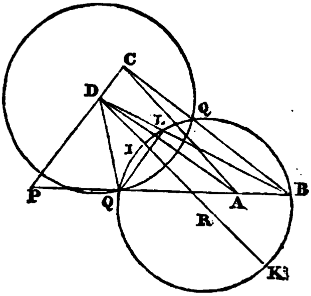
Constr.—On EG, the given diagonal, describe the segment EFG of a circle to contain an angle equal to one of the given angles; complete the circle, and take the arcs ECB, BAF equal to the doubles of other two given angles; through the points F, E describe a circle so, that the segment FDE may contain an angle equal to the remaining angle, and through its centre O draw from B the straight line BDD′ intersecting it in the points D, D′; through either of which, as D, draw from E, F the straight lines EA, FC meeting the first circle again in A, C; join AB, BC, and ABCD is the required trapezium.

Dem.—Join AC, FG, FE. The angles DAB, DCB, or EAB, FCB, being the halves of the subtended arcs ECB, BAF, are equal to two of the given angles, and ADC is equal to FDE, a third given angle by construction. Therefore the remaining angle ABC is equal to the given angle GFE, or the circular segments GFE, ABC are equal, and consequently AC is equal to GE, the given diagonal; and (Euc. 8, 3.) the other diagonal DB is a max. or a min.—Q.E.D.

To avoid complexity in the diagram, we have only drawn the trapezium with the minimum diagonal DB. In the case of the maximum diagonal D′B, the angle at D′ will obviously be the supplement of the angle ADC.

The construction will be the same when the diagonal is given, provided it be greater than DB and less than D′B; only instead of drawing BD′ through the centre of the circle FDE, we must describe about B as a centre a circle with a radius equal thereto, and its intersection with the former circle determines *d, d.*

By the Proposer.



1. When the other diagonal is equal a given line.

Suppose the trapezium ABCD the one required. Let the opposite sides BA, CD meet at P; draw DQ, making the angle PDQ equal angle PAC, and QL parallel to PC. Because of equiangular △s, PA : PD = AC : DQ, and AC is given; or DQ is given. Also PC : PB, PC : PQ; and, thence, PB : PQ = DB : DL are given ratios, and DB a given line: therefore BL, LD are given. Now, the angle BQL = BPC is given, or the locus of Q is a given circle on BL; D is a given point in BL; and DQ = a given line; or the locus of Q is another given circle to the centre D. The intersection of these circles determines Q, as also the triangle BQD: and thence, the whole.

2. The maximum and minimum of AC are immediately deducible from the above.

For AC : DQ is a given ratio; and, consequently, when AC is a maximum or minimum, DQ will be the same; which, evidently, will obtain, when DQ passes through R, the centre of the circle on BL; as DIK: the greatest limit being DK, and the least DI.

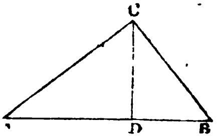
The first case of the above is the same as Prob. 74, Appendix, Simpson's Algebra.

The Rev. Brice Bronwin solved this problem geometrically, after the method of Mr. Simpson, Prob. 74, App. to Algeb. He also gave an Algebraical solution; as did Mr. J. Baines.

(258) *By* Mr. JESSE WINDWARD.

Given the least leg of a right angled plane triangle to construct it geometrically, when the rectangle under the hypothenuse and difference of the legs is equal to the area of the triangle.

By Messrs. SHEPHERD and STRINGER.



Let ACB represent the △ sought; from the right ∠ C draw CD perpendicular to AB; then, in the sim. △s ACB, BCD, we have $AC^2 . CB^2 = AB^2 . CD^2 = AB^2 . 4(AC - CB)^2 = 4AB^2(AC^2 - 2AC . CB + CB^2)$ by the question. But $AC^2 + CB^2 = AB^2$: Whence, by substitution and division, we get $CD^2 = 4AB^2 - 8AB . CD$, or $5CD^2 = 4AB^2 - 8AB . CD + 4CD^2$. Therefore $CD . \sqrt{5} = 2AB - 2CD$, or $AB : CD :: 2 + \sqrt{5} : 2$, a given ratio; or the triangle ACB is given in species, (Dat. 77,) and as the side BC is given, the construction is manifest.

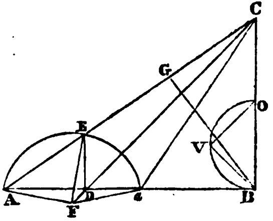
By GEOMETRICUS.

Since, by well-known properties, the area of any right angled plane triangle, or half the rectangle of the legs, is equal to the rectangle of the segments (A and B) of the hypothenuse made by the contact of the inscribed circle, and their difference is equal to the difference $(A - B)$ of the said segments,—the question requires, that $A . B = (A + B) . (A - B) = A^2 - B^2$. Therefore $(A + B) . B = A^2$; that is, the hypothenuse is divided at the point of contact in extreme and mean proportion, or in a given ratio.

Hence, if we divide (by Euc. 11, 2.) any assumed straight line into two parts (A, B) in extreme and mean proportion, and upon the whole line as an hypothenuse construct a right angled triangle (by Euclid's Data 88,) so that the rectangle of the sides about the right angle shall be equal to twice the rectangle of the segments A, B, thus found, this triangle will evidently be similar to the required one. Or, since we have given, the rectangle $= 2A . B$, and the difference $= A - B$, of the two legs, the legs become known by Lineal Section. Whence the construction is manifest.

If the hypothenuse be assumed $= 2$, we deduce (from Euc. 11, 2,) $A = \sqrt{5} - 1$, and $B = 3 - \sqrt{5}$. Hence, the legs of the triangle given in species, are, $\sqrt{[4\sqrt{5} - 7]} + \sqrt{5} - 2$, and $\sqrt{[4\sqrt{5} - 7]} - \sqrt{5} + 2$.

Otherwise, by the same.



Const. Bisect the given leg BC in O; on the diameter BO describe a semicircle, and draw OV bisecting the arc in V; in the indefinite perpendicular AB, take DB equal BC; join DC, in which produced determine (by Prob. II, Book 1, Geom. Amusem.) the point F so, that the rectangle FD . FC shall be equal to the square of OV; then from F to AB apply $FA = OV$; join AC, and ABC is the required triangle.

Dem. Draw BG perpendicular to AC, and DE to AB meeting AC in E; join FE, BV. Because DB equals BC, and DBC, BDE are right angles, the angles CDE, CDB, ADF are each half a right angle; but (per Constr.) $FD . FC = AF^2$, or $FD : AF :: AF : FC$, and so the triangles AFD, AFC, having the sides about the common angle F proportionals, are similar: Hence $\angle FAC = ADF = CDE$: therefore the points A, F, D, E are in a circle, and the angle $AEF = ADF = FAE$, or half a right angle. Therefore $AE = EF = OV = BV$ (by Constr.), and because the arc of the semi-circle BVO is bisected in V, the angles BOV, OBV are each half a right angle: consequently the triangles AFE, BVO are similar and equal in all respects. Therefore $AE = BO = \frac{1}{2}BC$: Hence AD is $= \frac{1}{2}BG$, because the triangles ADE, BGC are similar. Therefore the rectangle $AC . AD$ or $AC . (AB - BC) = \frac{1}{2}BG . AC =$ the area of the triangle ABC.—Q.E.D.

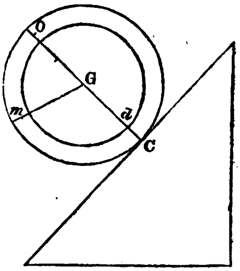
Assuming BC $= 1$, the preceding solution gives AC $= \frac{1}{4}[\sqrt{(17 + 8\sqrt{5})} + 1]$; which multiplied by $\sqrt{[4\sqrt{5} - 7]} - \sqrt{5} + 2$, the less leg of the triangle as found in the first solution, the product is 2, equal the assumed hypothenuse in that solution, as it ought to be by similar triangles,—thus proving the truth of the several results.

Ingenious solutions were given by the Rev. Brice Bronwin, and by Messrs. Winward, Jerwood, and Baines.

(259) *By* MR. H. LIGHTBOWN.

In what time will a heavy hollow cylinder 3 inches regular thickness, roll down an inclined plane whose length is 100 feet, and the perpendicular height 12 feet, its internal diameter being 2 feet?

By the Rev. BRICE BRONWIN.



Let the two circles in the annexed figure, whose centre is G, represent a section of the cylinder perpendicular to its axis; and let O denote the centre of oscillation with reference to the point of contact C of the cylinder and the plane, considered as a centre of suspension.

Put GC $= a$, G$d = b$, $p =$ 3.1416, and G$m = x$, (m being some point between the two circles.) Then OG $= \frac{\sqrt{pxx'x^2}}{\sqrt{apxx'}} = \frac{\frac{1}{4}px^4}{\frac{1}{2}apx^2} =$ (taken between $x =$ Gd and $x =$ GC,) $\frac{a^4 - b^4}{2a(a^2 - b^2)} = \frac{a^2 + b^2}{2a} = \frac{41}{40}$ feet. Put this $= g$.

Now, by Emerson's Mechanics, Prob. 61. Cor. 2, the space described by the cylinder rolling down the plane, is to the space it would describe in the same time sliding as CG to CO, i.e., as a to $a + g$. Therefore, whilst it rolls down the given plane, it would slide down another of the same elevation, whose length is to the length of the one given as $a + g$ to a. But this time is $\frac{a+g}{a} 100 \div \sqrt{\left[\frac{a+g}{a} . 12.16\frac{1}{12}\right]} =$ $100 \sqrt{\left[\frac{a+g}{193a}\right]} = 9''.71$ or $9'' \, 42'''.6$.

By Mr. J. Ogdin Marsh.

Let b represent the outer and a the inner radius. Then, the square of the radius of gyration will be $\frac{b^2 + a^2}{2}$; and if the weight of the cylinder be called 1, the weight which, posited at the outer circumf., might have the same rotatory motion, would be $\frac{b^2 + a^2}{2b^2}$. But the angular velocity of the circumference is the same as the velocity of the centre: hence the force which accelerates the cylinder down the plane will be to the force which accelerates the same body when it slides as $1 : 1 + \frac{b^2 + a^2}{2b^2}$. Now, put T = time of sliding down the plane; then the time being inversely as the square root of the force, other circumstances remaining the same, we shall have $T \times \sqrt{\left[\frac{3b^2 + a^2}{2b^2}\right]} =$ $9''.71$ for the time required.

By Amicus.

Considering the point on the cylinder which touches the plane perpendicularly under its centre of gravity as the centre of suspension, the distance of the centre of oscillation from that point is readily found to be equal $\frac{3}{2}R + \frac{r^2}{2R}$, where R, r denote the external and internal radii of the cylinder. Let this distance $= d$, and put $l = 100$, $h = 12$, $g = 16\frac{1}{12}$, $s = h \div l =$ the sine of the plane's elevation, and x for the time required. Then (by Cor. 4, Art. 258, Gregory's Mech.) if the cylinder were to slide down the plane, the space descended in the time x would be sgx^2; and (by Cor. 3, Art. 315, ibid., or by Emerson's Mech., Cor. 2, Prop. 61,) space passed over by sliding : space passed over by rolling :: $d : \mathrm{R} :: sgx^2 : l$; therefore $dl = \mathrm{R}sgx^2$, and $x = \sqrt{\frac{dl}{\mathrm{R}sg}} = \frac{l}{\mathrm{R}} \sqrt{\left[\frac{3\mathrm{R}^2 + r^2}{2gh}\right]} = 9''\frac{7}{10}$, or $9''\ 42'''$, the time required.

Cor. 1. Hence, if the cylinder be not hollow, or $r = 0$, $x = l\sqrt{3} \div \sqrt{2gh}$.

Cor. 2. As the radius does not enter into this expression for the time, it appears that all cylinders (*cæteris paribus*) roll down equal lengths of the same inclined plane, in the same time, whatever may be their diameters.

Cor. 3. If the cylinder be indefinitely thin, or $\mathrm{R} = r$, $x = 2l \div \sqrt{2gh}$.

Cor. 4. The time in which a solid cylinder rolls down an inclined plane : time in which an indefinitely thin cylindrical shell rolls down an equal length of the same :: $\sqrt{3} : 2$.

Mr. Jerwood gave a solution to this question.

(260) *Prize Question, by* AMICUS.

If an astronomer should be sent from Greenwich to observe the transit of Mercury over the sun which will happen this year (1822), it is required to determine the nearest distance and the direction he must travel to see the beginning of the transit at sun-rise.

By the Proposer.

To give a complete solution to this interesting question we must determine,

1. The time of the ingress at Greenwich.

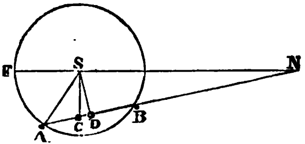
2. The point in the *Circle of Illumination* nearest to Greenwich at that time.

1. The elements of the transit, as computed from mean noon Nov. 4th, 1822, from the accurate tables of M. Delambre, are as follow :

⊕'s Longitude	1s. 11° 32′ 11″
☉'s Horary motion in lon.	2′ 30″ .55
☉'s Semi-diameter	16′ 10″ .25
⊕'s Distance from the ☉, the mean dist. being unity. =	.99114

☿'s	Longitude	1s. 8° 40′ 00″
	Horary motion in longitude	14′ 53″.7
	Horary motion in latitude	1′ 49″ $\frac{1}{6}$
	Heliocentric lat. South decreasing	55′ 30″
	Distance from the sun, the mean dist. being .38710.	= .31604
Hence the dist. of ☿ from the ⊕ =		.67510

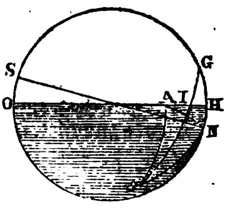
Now, as 12′ 23″.15, the relative hor. mot. of ☿ in respect to the ⊕ in long. : 1h. :: 2° 52′ 11″ = ⊕'s long. — ☿'s long. : 13h. 54′ 6″. Therefore the conjunction will be Nov. 4d. 13h. 54′ 6″, when the true long. of ☿ or ⊕ will be 1s. 12° 7′ 4″, the heliocentric and geocentric latitudes being 30′ 13″ and 14′ 8″.7 respectively, the latter of which, being less than the sun's semidiameter, shews that there will be a transit of Mercury at the centre and consequently somewhere upon the surface of the ⊕.



Let the circle FAB represent the sun's disc, S its centre, FSN a portion of the ecliptic, SC perpendicular to it and = 14′ 8″.7, then C will be the apparent place of the planet in conjunction. Let ACDBN represent the orbit of Mercury as seen from the earth, SD being perpendicular to it, which will bisect the chord AB in D, the middle of the transit. Now, as 12′ 23″.15 : 1′ 49″$\frac{1}{6}$ :: rad. : tan. 8° 21′ 21″ = ∠ ANF, and rad. : sine 8° 21′ 21″ :: 14′ 8″.7 : 2′ 3″.33 = DC; also, as .6751 : .31604 :: 743″.15 : 347″.9, and co-sine 8° 21′ 21″ : rad. :: 347″.9 : 351″.63 the hor. mot. of ☿ in his rel. orb. AN. Then, as 351″.63 : 1h :: 2′ 3″.33 : 21′ 2″ = the time of describing DC; which added to the time when ☿ arrives at C, gives Nov. 4d. 14h. 15m. 8s. for the middle of the transit. Again, rad. : co-sine 8° 21′ 21″ :: SC = 14′ 8″.7 : 13′ 59″.7 = SD, the nearest distance of the planet from the sun's centre. Now AS = 16′ 10″.25 and SD = 13′ 59″.7 are given to find AD = 8′ 6″.09 the semichord, the time of describing which = 1h. 22m. 58s., and this, subtracted from the time of the middle, gives

12h. 52m. 10s. for the beginning of the transit, mean time at Greenwich.

2. Let OSGH represent the earth's enlightened hemisphere, OAIH the Semi-circle of Illumination to which the sun is rising at the time of the ingress, and *g* the position of Greenwich at the same time. Then, the beginning of the transit being visible to every part of that semicircle, it is evident, that the perpendicular *g*A, drawn from Greenwich to the Circle of Illumination is the nearest distance required. Let G be the position of Greenwich at noon, NS the earth's axis, and draw the great circular arcs *g*N, AN, and GI*g*.



The sun's declination at the time of the ingress, i.e. the arc OS, or HN, will be 15° 27′ nearly, and the angle GN*g* = 166° 57′ 30″. Then in the isosceles spherical triangle GN*g*, the sides GN, *g*N each equal 38° 31′ 20″ the co-lat. of Greenwich, and the horary angle GN*g* = 166° 57′ 30″ are given, to find the side G*g* = 76° 27′ 38″ and the angle NG*g* or N*g*G ≐ 8° 19′. And in the right angled spheric triangle GHI, the leg GH = 23° 4′ 20″ the difference between the co-lat. and the sun's declin. OS or HN, and the angle G = 8° 19′: Hence GI = 23° 17′ 38″ and the angle GIH or *g*IA = 82° 21′ 10″. Also, in the right angled triangle *g*AI are given *g*I the difference between G*g* and GI, and the angle *g*IA: whence the angle I*g*A ≐ 12° 19′ 23″, and the leg A*g* = 52° 29′ 30″, the nearest distance sought. Therefore the angle A*g*N or the direction is 20° 38′ 23″ East from the North.—To find the latitude and longitude of A, in the oblique spheric triangle A*g*N, two sides and the included angle are known: whence the co-lat. AN = 20° 10′, and the ∠ AN*g* = 125° 46′ 25″. Consequently the latitude of A is 69° 50′ N., and its longitude 125° 46′ 25″ East from Greenwich; which place falls in the North part of the Russian Empire, near the river Lena in Siberia.

Besides the preceding elaborate solution by our correspondent Amicus, we were favoured with sketches of solutions from Mr. John Baines and the Rev. B. Bronwin.

THE

LEEDS CORRESPONDENT,

A

Literary, Mathematical, and Philosophical Miscellany.

Tarda fluunt ingrataque tempora, quæ spem
Consiliumque morantur agendi gnaviter id, quod
Æque pauperibus prodest, locupletibus æque;
Æque neglectum pueris senibusque nocebit.
HORAT.

No. IV. OCTOBER, 1822. Vol. IV.

REVIEW.

The Life of WILLIAM HEY, ESQ., F. R. S., *Member of the Royal College of Surgeons, in London, &c. &c.*—By JOHN PEARSON, F. R. S,

(Concluded from Page 184.)

HAVING completed our account of the life of Mr. Hey, who was an honour to the town of Leeds, and whose name will never be mentioned without respect and veneration in any part of the kingdom in which his worth has been known, we shall conclude our Review of this work with a few incidental remarks.

The statement of the various inroads which death made in Mr. Hey's family, and of the manner in which he not only submitted to the severe providential dispensations, but endeavoured to profit by them, affords us an elevated view of his Christian character and gracious attainments. He lived to see five of his posterity deposited in the tomb, after they had severally attained to the age of maturity, and had begun to be useful to mankind in their different vocations. Under these painful circumstances, it is said of the venerable parent, "unlike those who are in haste to abandon the mortal remains of their relatives, he saw nothing frightful, or revolting, in the dead bodies of his children; he contemplated each of them, when placed in its coffin, as consigned to sleep peacefully till the morning of the resurrection, while his soul was cheered and refreshed by the persuasion, that to them might be applied those consoling words heard from heaven by the writer of the Apocalypse: 'Blessed are the dead that die in the Lord.'—On the morning of the funeral he was accustomed to withdraw into the room where the corpse of his beloved child was placed; there, in holy acts of devotion, he solemnly resigned to God the gift which had been recalled; and expressed unfeigned gratitude to his heavenly Father for the comfort he had so long enjoyed whilst exercising the trust reposed in him. Above all, he gave thanks that the child was delivered from the vanities and miseries of this evil world, and, through the mercy and grace of the Redeemer, was admitted to partake of the heavenly glory and blessedness. Mr. Hey was wont to say, on the death of his children, 'that his ultimate end respecting them was answered, inasmuch as he had trained them up to become inhabitants of that kingdom into which he trusted they had been mercifully received.'"

We can find no room for what is well observed concerning his early associates, Mr. Henry Jowett, the Rev. Miles Atkinson, Dr. Isaac Milner, Mr. John Jowett, and Dr. Joseph Jowett. One of the most interesting portions of the work, is, the *Character of Mr. Hey, as a Magistrate, drawn up by* JOHN HARDY, *Esq.*, the present benevolent and highly accomplished Recorder of the Borough of Leeds.

"In the year 1786, Mr. Hey was elected an Alderman of the Borough of Leeds, and in the following year he was appointed to the office of Mayor.

The high importance of this situation, and the arduous nature of his duties as Chief Magistrate may be conceived, when it is stated, that the circle included within his jurisdiction a population of about 50,000 inhabitants. The new duties and obligations which the office of a Magistrate imposed upon him, excited him to an assiduous study of the law; and by the vigour and diligence with which he pursued his inquiries, he soon acquired a competent share of information in those departments of legal science by which he was to be directed and sanctioned, in executing the functions of magistracy. He became a good lawyer, and has been often known to correct the errors of the Counsel, when, with great confidence, they were laying down the law to the magistrates at the Sessions."*

The history of his official contest with vice and profaneness in their strong-holds and fastnesses, and of the rare admixture of zeal and prudence, which characterized his conduct, is worthy of more particular record than we can give to it. Mr. Hardy says, " He had also, so early as 1786, in order to prepare the minds of those against whom these laws were to be put in force, been mainly instrumental in establishing in the town of Leeds an Association, the object of which was 'to bring to justice all persons who should be guilty of those open immoralities, for which our excellent laws have provided just punishments;' and extracts of those laws were published in a small pamphlet of twelve pages, regarding the profanation of the Lord's day, drunkenness, cursing, and swearing, lewdness, gaming, vagrants, and false weights and measures, 'in order that none might plead ignorance of the penalties to which their vices might subject them.'

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* We personally recollect an instance of this description, many years ago, at one of the Quarter Sessions for the Borough of Leeds, at which Mr. Hey did not preside as Chief Magistrate, but only sat on the Bench as a Justice Assessor. A Barrister had entered on the defence of a person who was indicted for keeping *a house of ill fame;* and, to produce an effect on the minds of the Jury in favour of his client, or perhaps, to shew his employer that he did not receive his fee without the performance of some labour, the learned gentleman adduced what he called " legal arguments," and was proceeding to give certain other reasons why prostitution ought, in his opinion, to be allowed in society, when he was very properly interrupted by Mr. Hey, who after a very spirited reproof, answered his arguments, shewed that the law of the land sanctioned the perpetration of no crime, and advised him to pursue some other line of defence.—The Barrister, " nought abashed," complied with this request, and it is unnecessary to add, (since the evidence was of the strongest kind,) that his client was convicted.

"Notwithstanding, however, these wise, considerate, and humane precautions, no sooner had the new Mayor commenced an attack upon the citadels of vice, than all their garrisons were up in arms against him; and there is too much reason to fear that he experienced opposition, even in a quarter from which he had a right to look for assistance and support. The outcry was very great among those in particular who expected their profits to be diminished, or their career of sensual indulgence to be checked by the regulations which the Mayor was determined to enforce. Nor few in number were even those well-meaning individuals, who, while they would shrink with horror from the idea of countenancing those immoralities against which the rod of the law was now lifted up, yet viewed these proceedings as introducing an unnecessary strictness in the control of men's private conduct, and were less prone to commend the Mayor for his exertions, than to pity him for this apparently gratuitous exposure of himself to the consequences which all anticipated, himself not excepted, from those persons whose irritation would be excited by a diminution of their gains, or a restraint upon their criminal indulgences.

"Anonymous letters of the most scurrilous description, were among the secret means employed to deter him from the prosecution of his purpose; and actions at law were not only threatened, but actually instituted against himself and the constables, in every instance where the zeal of duty, or the imprudence and indiscretion of inferior officers intrusted with the execution of process, had prompted, in the most trifling degree, a vigour that the rigid requirements of the law did not seem to justify.

" Mr. Hey took on himself the responsibility of defending the constables where they had acted by his authority, but those who admired and approved his conduct did not allow him personally to bear the expense of resisting this persecution; and subscriptions to the amount of his disbursements, among which the initials W. W. hold a conspicuous place, rescued his countrymen from the imputation of permitting him to be a pecuniary sufferer in such a cause.

" The reader will have no difficulty in recognizing, under the initials W. W.* the strenuous friend and supporter of every plan for promoting the temporal and eternal interests of his fellow-mortals, in whatever way it is to be effected. Mr. Hey had the happiness and privilege of enjoying the confidence and friendship of this excellent man in an eminent degree; and, indeed, it would not be easy to find two men more likely to cultivate the esteem of each other, by a greater congeniality of sentiment on subjects connected with the highest interests of religion and morality, and a more fervid zeal in every hallowed cause.

" The obstruction and opposition, the obloquy and persecution, the secret threats, the public insults, and the personal dangers to which he exposed himself by the conscientious discharge of his duty as Mayor, were lamentable and disgraceful evidences of the depraved morals and corrupt principles which pervaded a large portion of the community. But the unblemished integrity of his character, the uprightness of his intentions, the purity, disinterestedness, and benevolence conspicuous in his conduct, were at length acknowledged and appreciated, and opened the way to a final triumph, not only over the malice but the errors of his adversaries.

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* The virtuous individual to whom Mr. Hardy refers, under the initials W. W., it is scarcely necessary to state, was the honourable William Wilberforce, Esq. M. P. the bare mention of whose name in Great Britain, and throughout the civilized world, is its own sufficient eulogy.

"There is great justice in that remark made by Colquhoun, in his book on police:—'Nothing contributes in a greater degree to deprave the minds of the people, than the little regard which laws pay to morality by inflicting more severe punishments on offenders, who commit, what may be termed, political crimes, and crimes against property, than those who violate religion and virtue.'"

Mr. Hey's manly and intrepid conduct at the beginning of the late eventful revolutionary war, is only that which every reader will be induced to expect from a man of such enlarged philanthropy and exalted piety, in whose mind the two members of the Apostolic precept, (FEAR GOD, HONOUR THE KING,) were never separated. At that grand national crisis he roused the principal persons in the town of Leeds to exertion, "and they both steadily and effectually co-operated with him in opposing levelling and revolutionary principles, and in exciting and cherishing a spirit of loyalty to the Government, and affection to the best interests of the State." To the wisdom, coolness and intrepidity of such men as Mr. Hey, we are indebted under God for our present posture of security, and for our complete exemption, as a people, from the cruel rod of the oppressor, that held at one period every other European nation in a state of abject bondage. That crisis, let it be recollected, was the more dangerous, on account of the chivalrous and enthusiastic feelings with which many persons of the highest intellectual endowments, and of unquestionable piety, hailed the commencement of the French revolution as the dawn of a brighter æra for the human race, the harbinger of an exalted condition of society, " by bards and prophets long foretold." To encounter the prejudices of the uninstructed multitude, who understood very little about the new order of things, except that the French " had formerly been slaves and worn wooden shoes," but were then emancipated,—was, of itself, a work of no small difficulty: But it was rendered still more difficult by the amiable yet misapplied feelings, and the rash interference, of the individuals to whom we have just alluded. To us, who have been accustomed from " our youth upwards" to contemplate, with deep interest, the diversified progress of that contest between good and bad principles, it has always appeared, that the victory in favour of religion and social order would not have been decided so quickly and satisfactorily as it was, had not the French revolution exhibited in its earliest stage " every passion's wild excess,"—the sanguinary ferocity of unbridled appetites, with the fanciful theories and detestable effects of triumphant Atheism. Better results can never be anticipated from any great national change, in the basis of which the Christian religion finds no acknowledgment or support. It was through the absence of this corrective of every thing bad in human nature, that the boasted " Age of Reason" proved a temporary curse to mankind; and if some of its effects have been of a higher and more sanative order, the only satisfactory solution which we can assign for the discrepancy, is,—they have had this tendency in consequence of that wonderful property in the Divine Economy of mundane affairs by which the Moral Governor of the universe "from seeming evil still educes good." Mr. Pearson's judicious reflections on this subject, are those of an enlightened Christian patriot.

"In the year 1801, Mr. Hey was elected, a second time, the Mayor of Leeds. He executed the duties of his office with the same conscientious regard to the obligations of his oath as before, and was not less firm and active in repressing the vicious infringement of the laws, by opposing whatever tended to the corruption of good morals; and in so regulating the civil economy of the town, as to promote that order and decency which are essential to the peace and prosperity of the community. In a letter to one of his daughters, he expresses himself surprised that he could pass through the streets without insult; since he persisted in strictly enforcing the observance of the laws enacted for the regulation of public houses, and was vigilant in suppressing certain practices which are prohibited by the wisdom of the Legislature, as unfriendly to industry, and tending to cherish improvidence, disorder, and crime among the labouring classes of the people. The talents, resolution, and character of Mr. Hey were better understood and more correctly appreciated, at this period, than at the commencement of his first mayoralty. The unsullied reputation he had long sustained, his active and benevolent efforts for the welfare of his townsmen, the conspicuous services which his unwearied zeal and disinterested patriotism had rendered to society, had secured to him the regard and support of the enlightened friends of virtue, of religion and their country. Whatever secret rancour might be harboured by those who hated his piety, and were inimical to his political principles, they were discreet enough to refrain from any public expression of it, and to treat him, in general, with decency and respect.

"He was among the earliest promoters of the abolition of the Slave Trade, co-operating with his parliamentary friends and others in exciting a general detestation of it, and steadily supporting every measure that tended to the extinction of that unchristian and abominable traffic. When the Sierra Leone Company was formed, he immediately became a member, subscribing largely (five hundred pounds) to its stock, and employing his influence with others, to advance the great and useful purposes for which it was originally established. Mr. Hey was indeed zealous and unremitting in his endeavours to promote those just and benevolent purposes which were pursued with laborious and unwearied perseverance by Mr. Wilberforce and others, to rescue the unhappy natives of Africa from the barbarous, unjust, and scandalous treatment of their christian oppressors."

His connection with the British and Foreign Bible Society, the Church Missionary, Sunday Schools, and Educational Societies,—his zeal and activity in bringing before the British Public that dignified and impartial publication, THE CHRISTIAN OBSERVER,—and the pecuniary aid which he afforded to the Funds of the Baptist Mission in the East,—are conspicuous proofs of a great and benevolent character.

It is to be lamented, that any serious drawbacks to these and other appearances of a Catholic spirit in Mr. Hey, should have been furnished by his relatives: On some of these dark spots we have already animadverted. But it seems to us, that there is throughout the work a studied endeavour to depreciate the religious denomination from which he thought proper, in 1781, to separate. The reasons assigned in this work for the resolution which he then formed and executed, seem inadequate and unsatisfactory; for at that period the Methodists in Leeds held no meetings during the celebration of the public worship in the Church: They attended all her ordinances, partook of the sacrament within her walls, and were generally as sincere and as loud in their admiration of her public formularies as Mr. Hey could be. When therefore his biographer says, "His firm attachment to the doctrines and discipline of the Church of England, as they are exhibited in her Articles, Homilies, and Liturgy, was the principal motive by which he was induced to dissolve his connexion with this body of Christians,"—he appears to us to offer a cause that by no means accounts for the effect. Had he known these reports to be facts, he might, without any disparagement to the memory of the deceased, have stated them as additional causes,—that Mr. Hey's mind had been recently wounded by an instance of culpable ingratitude in a religious Professor of Medicine who was then commencing business in Leeds,—that he and some other branches of the family cherished about that time well-grounded hopes of seeing his brother John's brow decorated with a Bishop's mitre,—that the increasing attachment of his rising family to a Church in which they had many connections, would naturally have some effect upon an affectionate parent,—and that Mr. Hey himself had begun to exhibit a decided leaning towards the Calvinistic school of Divinity, disguised as it frequently is in modern times under the specious name of BAXTERIANISM. Had all these causes concurred with the one alleged, and with others unknown, they would not have operated as any impeachment on Mr. Hey's moral rectitude: From a perusal of the previous delineation of his excellent character every one may be well assured, that he would have displayed none of that petulance, passion, or prejudice which distinguishes men of a common standard when they change their parties, civil or religious. No necessity therefore existed for framing repeated apologies for such a change in Mr. Hey; and we should certainly never have looked to find in this narrative the quarrels of Irish Methodists, and other matters altogether unconnected with Mr. Hey's personal history. We consider these re-iterated allusions to his secession, to be an absolute lessening of his character; for they reduce him to a level with inferior men, by making it appear as requisite in his case, as in that of more hasty converts, to prove the sincerity of his *last choice* by his louder and more violent railing against those whose society he had deserted. We never observed any feature of this description in Mr. Hey, and have not heard of it from others. The substance of his farewell address to the Methodist Conference, which, even in its abridged and polished form, wears the semblance of a cutting Diatribe, and the curious scene which ensued, ought not to have received that prominent notice which they have obtained. If Mr. Wesley had listened to every good man who in those days wished to offer him sage advice, he would undoubtedly have been guilty of far more serious innovations than those of which he here stands accused. Mr. Hey had previously declared, that if the preachers "rejected his proposals he could no longer remain a member of the Methodist Society." This was to assume the character of a Reformer in rather a high tone, and with the usual accompaniment of a *sine quâ non.* His biographer adds, "Mr. Wesley granted him permission to read his paper in full Conference; they listened with patient attention during the discussion of the first and second heads, which related, chiefly, to the importance of the Established Church, and the original principles of the Methodists: but when Mr. Hey was proceeding to shew how they had departed from those principles, some indications of uneasiness appeared among the preachers, and Mr. Wesley remarked, 'that as there was much other business before them, Brother Hey must defer reading the remainder of his paper to another opportunity;' this opportunity, however, never arrived; hence Mr. Hey was accustomed to say, that 'he did not leave the Methodists—they left him.'"

But, to omit all mention of Christian Charity, '*which hopeth all things*,'—especially concerning those under whose ministry a man acknowledges himself to have received his first correct views of Christianity,—we must account it exceedingly ill-judged on the part of any relative to give to the world such a paragraph as the following, which occurs in the Second Appendix, and is entitled *Advice to his Children:*

"From what I have been able to collect from the New Testament, (and I have paid considerable attention to this point,) it is clear to me, that an episcopal government is most like that which prevailed in the first ages of the Church. There is one thing which I have frequently lamented, and which I believe I must lament to my dying day, that there are no associations of real Christians in the Established Church. Among the Dissenters and the Methodists you may have a ticket from one body of Christians to another; but with us there is no such connexion among serious professors. I would recommend this to the consideration of those among you who may be in the ministry. I think, however, taking a body of religious men in the Church, and another among the Dissenters, there is much more of the true spirit of Christianity in the former than in the latter. There are in the Dissenters of the last century, many things deserving of our imitation. I take it, there was more learning, not mathematical indeed, but classical and theological, than in the Church. But they are now quite a different people. I shall not see it, but I have no doubt some of you will live to see the Methodists separated from the Church, and their descendants infidels."

We have more than once delivered our high opinion of Mr. Pearson as a biographer; (pages 88 and 105;) and his good sense has prompted him to add this note to the last sentence: "Might not "Mr. Hey have meant, that *they would probably* "*fall into some great errors?*" Were we inclined to imitate Mr. Hey, and to summon up our prophesying propensities, we would repeat, in behalf of the unhappy individuals whose DESCENDANTS will be INFIDELS, what a near relative of one of the highest dignitaries of our Church wrote, in 1746, at the execution of one of the rebel Lords:

> And yet [these people] may find room
> Where GREATER FOLKS but seldom come.

We would also add this prophecy,—that we shall expect much sooner to see the present race of Methodists closely approximating and finally adhering to the Church, in whose bosom all their great men were cherished, than to see them and their descendants receding from the Establishment.—But dismissing all attempts at prophecy, which when proceeding from unhallowed lips sounds most uncouthly, we would recommend that person who feels inclined, as in this most flagrant instance, to slander this denomination of Christians, first to try to excel them in amiable dispositions, upright conduct, and acts of piety. When he has gained such a marked pre-eminence over these his adversaries, the evil inclination to malign them will probably have passed away; and if he should afterwards approach them with any other feeling than one of esteem or friendship, it will be with that of compassion for the errors and failings which he may have discovered. This will be a sovereign remedy against a narrow and sectarian spirit.

As members of our venerable Church Established in these Realms by law, we heartily coincide with all that Mr. Hey is stated to have spoken in favour of her episcopal regimen and devotional formularies. We leave the Dissenters to decide for themselves respecting that part of our preceding extract in which the palm is, on comparison, assigned to "religious men in the Church," for possessing "much more of the true spirit of Christianity." Our wish on this subject is, *O si sic omnes!* "Would God, that ALL the Lord's people in the Church of England were prophets" in the New Testament sense of this expression; "and that the Lord would put his Spirit upon them!"

But when Mr. Hey says, in the same extract, "I take it, there was, in the Dissenters of the last "century, more learning, not mathematical indeed, "but classical and theological, than in the Church," —we beg to demur, and to ask in the language of his able biographer, "Is not this too strongly expressed to be readily admitted?" As this was spoken in 1797, it must refer to the preceding century, 1600. In that case it was intended to apply to the Nonconformists. But unless by "*theological* learning," is meant a knowledge of and adherence to the peculiarities of Calvinism, the remark is untrue even with regard to them, and will not apply. And in reference to "*classical* learning," what scholar ever saw any of that race of men quoted for such a qualification, with the exception, perhaps, of Selden, Gataker, and Milton? Mr. Hey has either been grossly misunderstood, or had at the time forgotton these famous critics and Divines,—Archbishops Sheldon, Abbot, Potter, Sancroft, Laud, Usher, &c.—Bishops Walton, Pearson, Fell, Bull, Ken, Beveridge, Taylor, Cumberland, Burnet, Patrick, Stillingfleet, Sanderson, &c.—Sirs Henry Saville, Henry Spelman, Henry Wotton, William Dugdale, &c.—the learned John Hales, Cudworth, Joshua Barnes, Bentley, Dodwell, Baker, Pocock, Barrow, Hammond, Lightfoot, Chillingworth, Boyle, Greaves, Echard, Grabe,—the Clarkes, Spencers, Stanleys, Kennetts, and fifty other scholars of the highest classical attainments that might be soon recounted. If we descend to a more recent period than that at which these great men flourished, Mr. Hey's position would be still more untenable.

"But," it is added, "they [the Dissenters] are now quite another people." It is difficult to collect the meaning of this sentence from its juxta-position. Is it intended to represent a deterioration in their "classical and theological learning," or in their piety? In either case, it is an unhandsome and misplaced insinuation against a body of Christians, with many of whom Mr. Hey was, for many years prior to his decease, in habits of the most intimate friendship, and with whom he thought it his duty to act on several public occasions, but particularly when the rival claims of Bell's system of education and that of Lancaster came to be decided. We have a proverb in Yorkshire, that says, "Every cock is permitted to crow on his own dunghill;" and it was in the exercise of such a privilege, that Mr. Hey very properly commended to his family the excellent Church within whose pale he lived. Let the Dissenters be accounted men of honour and integrity, as they have on a thousand trying occasions proved themselves to be, and they may also be allowed the exercise of the same privilege in the bosom of their own families: For, as men of principle, if they did not really possess a paramount attachment to their own body, they would soon act the part of Mr. Hey when he deserted the communion of the Methodists. Both parties may therefore be supposed without any breach of charity to say many things in the family-circle, which, though less caustic than those which Mr. Hey is stated on this occasion to have used, they would not wish to hear "published on the house-tops." In reference to this position, the relatives of the deceased who furnished those posthumous side-wind documents, which are here called "substances," should have first put the question to themselves, "Would our "honoured parent have openly declared to the "world, that *the Dissenters are now quite another* "*people*, and that *the descendants of the Methodists* "*will* (shocking catastrophe!) *become infidels*? Or "would he desire us to do it for him? If he "would not, are we shewing due respect to his "memory by employing the sanction of his name "to give currency to our own antipathies?" It is deservedly assumed, to the credit of the deceased, that he would not have made any such declarations, because since the year 1797 he had many opportunities to accomplish this design, which he never embraced. We have with great delight heard him deliver his sentiments, at various anniversary meetings of the Leeds Branch of *the Church Missionary Society*, but never heard a single word that bordered upon the expressions which are now the objects of our animadversion. We were much amused at the genuine wit and pleasantry contained in the last Missionary speech which the venerable old gentleman delivered; for though it bore hard on Dissenters for rejecting FORMS in *prayer* and employing them in *singing*, which he justly designated "prayer in verse;" yet, being spoken with affability and in perfect good humour, it gave no umbrage to the dissenting ministers who were present.

We have the authority of his biographer for saying, that Mr Hey "greatly regretted the separation of the Methodists from the Established Church; *but never spake of them in unkind and disrespectful terms.* Indeed, few men ever maintained a more friendly course of conduct, or displayed *greater candour and openness of heart*, than Mr. Hey, towards good men *of every denomination* of Christians."

If we were in the least inclined to be captious we might criticize several expressions, from other sources, that do not breathe the most enlarged philanthropy. But our readers will perceive, that while recording the virtues and exalting the character of Mr. Hey, we have endeavoured to render strict justice to other parties whose names and tenets, accompanied by notes and glosses, have been unaccountably dragged before the public.—Mr. Pearson is clearly exonerated from all portion of blame, and it would have afforded us great satisfaction to give copious extracts from his judicious and entertaining remarks on different topics that communicate great interest to the volume. But we close the whole by an affecting narrative, which gives an amiable view of Mr. Hey's solicitude for the eternal welfare of all who were brought under his care or within his influence, and which we present as a separate article under the following title, that is only a very small tribute of our respect for another most worthy yet unassuming gentleman, whose writings in our youthful days afforded us very important instruction and attractive entertainment.

NOBLE AND DISINTERESTED CONDUCT IN A BAPTIST MINISTER.

During the period of his (Mr. Hey's) mayoralty, there was an occurrence of too remarkable and interesting a nature to be suppressed. Mr. H. a young man, who was clerk in the banking-house of Messrs. Elam and Thompson, was brought before Mr. Hey under the charge of forgery. He was a member of a respectable family; many of his friends and connexions were persons of worth and piety, and he had conducted himself during several years with propriety and integrity. This young man had fallen, gradually, into the pernicious habit of drinking to excess; the indulgence of this destructive propensity requiring more money than his limited income could furnish, he had recourse to unlawful methods of acquiring pecuniary supplies. Having access to the printed bills circulated by country bankers, he secretly filled up some of them, and appropriated them to his own use: two of these notes rendered current by the signature of Elam and Co. were proved to be forged notes, and he was accused as the person guilty of this breach of trust. When brought before the Mayor for examination, the evidence against him was too strong and clear to admit of contradiction; he then confessed his crime, and appeared greatly agitated and alarmed by the fearful consequences attached to this violation of the law. The order for his commitment was signed; he was sent to the Leeds prison, and was to be transferred on the following day to York Castle. Mr. Hey felt great compassion for this unhappy youth, whom he did not regard as a hardened criminal, long practised in courses of dishonesty; and having no doubt that H—— would be condemned to suffer death, he determined to send for him to his own house, the same evening, that he might converse with and admonish him. When H—— was brought to the Mayor's house, he seemed to be scarcely sober; and his haggard look and trembling limbs indicated a constitution impaired by intemperance. A consciousness of the perilous situation into which his excesses had brought him, produced a deep dejection of spirits, and threw a gloomy wildness over his countenance, which presented him as an object of lively commiseration. Mr. Hey informed the prisoner that the purpose of this interview was to offer him advice which might be useful to him, under the melancholy circumstances to which his evil habits had reduced him. He then enlarged to H—— on the sin of drunkenness, on the state of degradation and wretchedness into which it had plunged him, on the difficulty of subduing habits strengthened by long indulgence, and the violent temptations to which he would be exposed, under the pressure of his troubles, to seek temporary relief from the reproaches of his conscience and the distress which would harrass his mind, by a recourse to intoxicating liquors. He assured him, that the evidence against him was too well supported to ~~admit of a doubt respecting the issue of his trial; that~~ the nature of his crime removed all hope of mercy from a human tribunal; that he must consequently abandon every expectation of acquittal, and prepare to die. Mr. Hey then seriously exhorted him to avoid intemperance, to read the Holy Scriptures with fervent prayer, and to seek earnestly the pardon of his sins and acceptance with God, through the merits and intercession of the Saviour of mankind. He further enjoined him, on his arrival at York, to request the visits of the Rev. William Richardson, and H—— promised that he would certainly comply with this injunction. The prisoner fulfilled this promise faithfully, soon after his confinement in the Castle.

Mr. Hey had the satisfaction of receiving a report from the Town-Clerk of Leeds, "that H——, from the time of his entering the Castle, had devoted himself to religious exercises and the concerns of his soul, and that he had become quite another man." This gratifying account was confirmed, a short time afterwards, by Mr. Richardson, who informed the Mayor, that H—— had sent for him on his first arrival at the Castle, that Mr. Richardson had constantly visited this unhappy criminal, and that he considered him as one truly penitent and converted to God.

H—— was tried at the ensuing Assizes, found guilty, and condemned to die, and was left by the Judge for execution. The family and friends of H—— were deeply affected by this train of mournful circumstances, among whom Mr. Fawcett, afterwards Dr. Fawcett, a Baptist Minister, who resided near Halifax, in Yorkshire, a man of superior talents, and distinguished worth and piety, exerted himself, with unwearied zeal and kindness to serve him.

Mr. Fawcett had published "An Essay on Anger," in the year 1787; and, by some means, this book had been recommended to the notice of our late pious and excellent Sovereign, George the Third. His Majesty was much pleased with it; he read it through twice, and said to some of his attendants, that he must make the author a Bishop. The King was then informed that Mr. Fawcett was a Dissenting Minister, and was consequently precluded from receiving any preferment in the Established Church. With that kindness and condescension, by which his Majesty was habitually actuated, he directed that Mr. Fawcett might be informed of the satisfaction he had derived from perusing his Essay, and of his desire to bestow some token of his royal favour upon him, when he should be informed how this could be done most acceptably to Mr. Fawcett. This good man being contented with the station allotted him by the Divine Providence, after expressing humbly his sense of the King's most gracious intentions towards him, declined asking any favour, except this, that his Majesty would condescend to accept a few religious publications, from which he hoped the King might derive further pleasure and advantage.

The family of H—— were not only well known to Mr. Fawcett, but H—— himself had formerly been an inmate, and probably a pupil in his house. When Mr. Fawcett heard of the condemnation of the criminal, and saw his pious relatives overwhelmed by distress, he was much affected, and sympathized tenderly with them in their affliction.

Having revolved this affair seriously and with much deliberation in his own mind, without communicating his intentions to any one, he formed the noble and benevolent purpose of using the permission given to him by his Sovereign, to ask the life of H—— as the greatest kindness which his Majesty could confer upon him. Accordingly, after offering up a solemn and fervent prayer to Almighty God for direction and assistance, Mr. Fawcett prepared a supplicatory address to the King, intreating, with much earnestness and the most pathetic representations, that the royal mercy might be extended to the condemned prisoner. He was well aware that this mercy had been refused to the most urgent and powerful applications in the behalf of Dr. Dodd and others, and that the King had expressed a determination of leaving the perpetrators of forgery to suffer the full rigour of the law. Under much anxiety, and scarcely cheered bv a single ray of hope, the petition was sent to London and presented to his Majesty, when, to the unspeakable surprise and joy of Mr. Fawcett, a letter soon arrived, addressed to him by a person in authority, conveying this welcome intelligence, "You may rest assured that his life is safe."

This assurance contained all that Mr. Fawcett had implored; he immediately sent a humble address of thanks to the King, accompanied by a small book, elegantly bound, which was graciously accepted by his Majesty.

H—— was transported to New South Wales, where his subsequent conduct has justified the good opinion formed of him by the pious and judicious friends who visited him during his imprisonment.

Since his arrival there, the Governor and Chaplain of the Colony have expressed their approbation of his behaviour; and H—— gained so far the confidence of the Governor, that he was employed by him in services of trust and importance; and, when many years had elapsed after his transportation, the Rev. Samuel Marsden continued to bear a favourable testimony to his general deportment.

Dr. Fawcett is dead; and his modesty cannot now be pained by the narration of circumstances, which, while living, he studiously endeavoured to withhold, even from his most intimate friends. But although his humility would have consigned this remarkable story to oblivion, it is recorded on high; it lives in the grateful memory of those surviving connections of H—— whose affliction found this unhoped-for alleviation; and it will remain a bright testimony of the genuine piety and disinterested kindness of this generous friend, whose timely interposition rescued the penitent criminal from death.

The character and disposition of our late most excellent Sovereign appear throughout this transaction in their simple and genuine beauty, exhibiting that condescension, goodness and piety, which rendered him pre-eminent as a most religious monarch, and distinguished him as one of the best men that ever swayed the British sceptre. The power and efficacy of our holy religion, neither degraded by superstition, nor evaporating in fruitless profession, shone with a steady unvarying radiance in George the Third, conciliating the affections, and commanding the veneration of those among his subjects who could appreciate his virtues and estimate his worth; and his name will be transmitted to posterity as a noble and illustrious instance of the union of christian graces with all those great and kingly qualities which were the support and ornament of his throne. He is gone to receive his eternal reward; to be crowned with unfading honour and glory; and to enjoy that uninterrupted peace and unmingled blessedness which are the portion of the people of God.

As it is the unquestionable duty of every member of the community to love and honour his king, so will it be the devout and fervent wish of every loyal subject, that our most gracious Sovereign, the illustrious successor to the throne of these kingdoms, may be exempted from the disquietudes, and adorned with the distinguished virtues of his Royal Father: that the Holy Spirit of God may descend and abide upon him, that, being enriched with heavenly grace, he may reign long in righteousness, prosperity, and peace.

DEATH OF WALTER SELBY.

I rede ye, my lady—I rede ye, my lord,
To put not your trust in trumpet and sword:
Else the proud name of Selby, which gladden'd us long,
Shall pass from the land like the sough of a song.
OLD BALLAD.

AMONG the various publications which have lately issued from the press, the *Traditionary Tales of the English and Scotch Peasantry*, by ALLAN CUNNINGHAM, Esq., in 2 vols. 12mo. have a claim upon the attention of the public. We are informed by the Author, in his Preface, that, "all these stories, with the exception of the first, appeared at different periods in the London Magazine:" but, as we do not suppose, that all who read the Leeds Correspondent also read the London Magazine, we are unwilling to exclude one of these stories from our pages on account of its previous appearance in another publication. To us "The *Death of Walter Selby*" which forms the third part of "THE SELBYS OF CUMBERLAND" appears to be one of the most interesting in either volume, especially on account of its connection with part of our National history. We therefore insert it.

Before Dame Eleanor Selby had concluded her account of the Spectre Horsemen* of Soutra-fell, the

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* The following is the account which the same Eleanor Selby (being, at the time when she relates it, 70 years old) is said to have given of this strange exhibition.

While I continued gazing, there appeared a sight on Soutra-fell side—strange, ominous, and obscure to many, at that time, but which was soon after explained in desolation and in blood. I saw all at once a body of horsemen coming swiftly down the steep and impassable side of the mountain—where no earthly horse ever rode. They amounted to many hundreds, and trooped onwards in succession—their helmets gleaming, and their drawn swords shining amid the starlight. On beholding this vision, I uttered a faint scream, and Walter Selby, who was always less sun had set—and the twilight, warm, silent, and dewy, had succeeded—that pleasant time between light and dark, in which domestic labour finds a brief remission. The shepherd, returned from hill or moor, spread out

or more than other men, shouted till the mountain echoed. "Saw ever man so gallant a sight? A thousand steeds and riders on the perpendicular side of old Soutra—see where they gallop along a linn, where I could hardly fly a hawk! O for a horse with so sure and so swift a foot as these, that I might match me with this elfin chivalry! My wanton brown, which can bound across the Derwent like a bird, with me on its back, is but a pack-horse to one of these." Alarm was visible in every face around—for we all knew what the apparition foreboded—a lost battle and a ruined cause. I heard my father say that the like sight appeared on Helvellyn side, before the battle of Marston-moor—with this remarkable difference—the leader wore on his head the semblance of a royal crown, whereas the leaders of the troop whom I beheld wore only earls' coronets.

"Now his right hand protect us!" said the Dame of Wilton-hall. "What are we doomed to endure?—what will follow this?"—"Misery to many," answered the Pedlar, "and sudden and early death to some who are present." "Cease thy croak, thou northern raven;" said Walter Selby—"if they are phantoms let them pass—what care we for men of mist?—and if they are flesh and bone, as I guess by their bearing they must surely be—they are good gallant soldiers of our good king, and thus do I bid them welcome with my bugle." He winded his horn till the mountain echoed far and wide—the spectre horsemen, distant nearly a quarter of a mile, seemed to halt—and the youth had his horn again at his lips to renew the note, when he was interrupted by the pedlar, who, laying his hand on the instrument, said, "Young gentleman, be wise, and be ruled—yon vision is sent for man's instruction—not for his scoff and his scorn." The shadowy troop now advanced, and passed toward the south at the distance of a hundred yards. I looked on them as they went, and I imagined I knew the forms of many living men—doomed speedily to perish in the battle-field, or on the scaffold. I saw the flower of the Jacobite chivalry—the Maxwells, the Gordons, the Boyds, the Drummonds, the Ogilvys, the Camerons, the Scotts, the Foresters, and the Selbys. The havoc which happened among these noble names it is needless to relate—it is written in tale—related in ballad—sung in song—and deeper still it is written in family feeling and national sympathy. A supernatural light accompanied this pageant, and rendered perfectly visible horse and man:—in the rear I saw a form that made me shudder—a form still present to my eye, and impressed upon my heart—old and sorrow-worn as it is—as vividly as in early youth. I saw the shape of Walter Selby—his short cloak, his scarlet dress—his hat and feather—his sword by his side—and that smiling glance in his deep dark eye which was never there but for me, and which I could know among the looks of a thousand thousand. As he came, he laid his bridle on his horse's neck, his hose—moistened in morass or rivulet—before the hearth fire, which glimmered far and wide, and taking his accustomed seat, sat mute and motionless as a figure of stone. The cows came lowing homewards from the pasture-hills; others feeding out of cribs filled with rich moist clover, yielded their milk into a score of pails; while the ewes, folded on the sheltered side of the remote glen, submitted their udders, not without the frequent butt and bleat, to the pressure of maidens' hands. Pastoral verse has not many finer pictures than what it borrows from the shepherd returning from the hill, and the shepherdess from the fold—the former with his pipe and dogs, and the latter with her pail of reeking milk, each singing with a hearty country freedom of voice, and in their own peculiar way, the loves and the joys of a pastoral life. The home of Randal Rode presented a scene of rough plenty, and abounded in pastoral wealth; the head of the house associated with his domestics, and maintained that authority over their words and conduct which belonged to simpler times; and something of the rustic dignity of the master was observable in his men. His daughter Maude, busied herself among the maidens with a meekness and a diligence which had more of the matron than is commonly found in so young a dame. All this escaped not the notice of her old and capricious kinswoman, Eleanor Selby; but scenes of homely and domestic joy seemed alien to her heart. The intrusion too of the churlish name of Rode among the martial Selbys, never failed to darken the picture which she would have enjoyed had this rustic alloy mixed with the precious metal of any other house. It was her chief delight, since all the males of her name had

and leaned aside, and took at me a long, long look. The youth himself, full of life and gladness beside me, seemed to discover the resemblance between the spectre rider and himself, and it was only by throwing myself in his bosom, that I hindered him from addressing the apparition. How long I remained insensible in his arms I know not, but when I recovered, I found myself pressed to the youth's bosom—and a gentleman with several armed attendants standing beside me—all showing by their looks the deep interest they took in my fate.

perished, to chant ballads in their praise, and relate their deeds from the time of the Norman invasion down to their ruin in the last rebellion. Many snatches of these chivalrous ballads are still current on the Border —the debateable land of song as well as of the sword —where minstrels sought their themes, and entered, harp in hand, into rivalry—a kind of contest which the sword, the critic's weapon of those days, was often drawn to decide. Much of this stirring and heroic border-life mingles with the traditionary tales of Eleanor Selby. Her narratives contain, occasionally, a vivid presentment of character and action. I shall endeavour to preserve something of this, and retain, at the same time, their dramatic cast, while I prune and condense the whole, to render them more acceptable to the impatience of modern readers. She thus pursued her story.

"I am now to tell a tale I have related a thousand times to the noble and the low—it is presented to me in my dreams, for the memory of spilt blood clings to a young mind—and the life's blood of Walter Selby was no common blood to me. The vision of the spectre horsemen, in which human fate was darkly shadowed forth, passed away—and departed too, I am afraid, from the thoughts of those to whom it came as a signal and a warning—as a cloud passes from the face of the summer-moon. Seated on horseback, with Walter Selby at my bridle-rein, and before and behind me upwards of a score of armed cavaliers, I had proceeded along the mountain side about a mile, when a horn was winded at a small distance in our front. We quickened our pace; but the way was rough and difficult; and we were obliged to go a sinuous course, like the meanderings of a brook, round rock and cairn and heathy hill, while the horn, continuing to sound, still seemed as far ahead as when we first heard it. It was about twelve o'clock; and the moon, large and bright and round, gleamed down from the summit of a green pasture mountain, and lightened us on our way through a narrow wooded valley, where a small stream glimmered and sparkled in the light, and ran so crooked a course, as compelled us to cross it every hundred yards. Walter Selby now addressed me in his own singular way: 'Fair Eleanor, mine own grave and staid cousin, knowest thou whither thou goest? Comest thou to counsel how fifty men may do the deeds of thousands, and how the crown of this land may be shifted like a prentice's cap?' 'Truly,' said I, 'most sage and considerate cousin, I go with thee like an afflicted damosel of yore, in the belief that thy wisdom and valour may re-instate me in my ancient domains—or else win for me some new and princely inheritance.' 'Thou speakest,' said the youth, 'like one humble in hope, and puttest thy trust in one who would willingly work miracles to oblige thee. But ponder, fair damsel—my sword, though the best blade in Cumberland, cannot cut up into relics five or six regiments of dragoons—nor is this body, though devoted to thee, made of that knight-errant stuff that can resist sword and bullet. So I counsel thee, most discreet coz, to content thyself with hearing the sound of battle afar off—for we go on a journey of no small peril.' To these sensible and considerate words I answered nothing, but rode on, looking, all the while, Walter Selby in the face, and endeavouring to say something witty or wise. He resumed his converse: 'Nay, nay, mine own sweet and gentle cousin—my sweet Eleanor—I am too proud of that troubled glance of thine, to say one word more about separation,'—and our horses' heads and our cheeks came closer as he spoke. 'That ballad of the pedlar, for pedlar shall the knight be still to oblige thee, his ballad told more truth than I reckoned a minstrel might infuse into verse. All the border cavaliers of England and Scotland are near us or with us,—and now for the game of coronets and crowns—a coffin, coz, or an earl's bauble—for we march upon Preston.'

"Prepared as I was for these tidings, I could not hear them without emotion, and I looked on Walter Selby with an eye that was not calculated to inspire acts of heroism. I could not help connecting our present march on Preston with the shadowy procession I had so recently witnessed; and the resemblance which one of the phantoms bore to the youth beside me, pressed on my heart. 'Now do not be afraid of our success, my fair coz,' said he, 'when to all the proud names of the border—names thou hast long since learned by heart, and rendered musical by repeating them—we add the names of two most wise and prudent persons, who shall hereafter be called the setters-up and pluckers-down of kings—even thy cool and chivalrous cousin, and a certain staid and sedate errant damosel.' This conversation obtained for us the attention of several stranger cavaliers who happened to join us, as, emerging from the woody glen, we entered upon a green and wide moor or common. One of them, with a short cloak and slouched hat and heron's feather, rode up to my right hand, and glancing his eye on our faces, thus addressed himself to me in a kind-hearted old Scottish style:—'Fair lady, there be sights less to a warrior's liking than so sweet a face beside a wild mountain, about the full of the moon. The cause that soils one of these bright tresses in dew, must be a cause dear to man's heart—and, fair one, if thou wilt permit me to ride by thy bridle-rein, my presence may restrain sundry flouts and jests which young cavaliers, somewhat scant of grace and courtesy —and there be such in our company—may use, on seeing a lady so fair and so young, bowne on such a dangerous and unwonted journey.' I thanked this northern cavalier for his charitable civility, and observed, with a smile, 'I had the protection of a young person who would feel pleased in sharing the responsibility of such a task.' 'And, fair lady,' continued he, 'since Walter Selby is thy protector, my labour will be the less.' My cousin, who during this conversation had ridden silent at my side, seemed to awaken from a reverie, and glancing his eye on the cavalier, and extending his hand, said, 'Sir, in a strange dress, uttering strange words, and busied in a pursuit sordid and vulgar,* I knew you not, and repelled your frank courtesy with rude words. I hear you now in no disguised voice, and see you with the sword of honour at your side instead of the pedlar's staff: accept, therefore, my hand, and be assured that a Selby—as hot and as proud as the lordliest of his ancestors, feels honoured in thus touching in friendship the hand of a gallant gentleman.'

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* This "stranger cavalier," is the same person mentioned in the preceding note as "the pedlar." He had assumed this disguise, that he might the more safely sound the feelings and opinions of the peasantry with regard to the situation of national affairs.

"I felt much pleased with this adventure, and looked on the person of the stalwart borderer, as he received and returned the friendly grasp of Walter Selby: he had a brow serene and high, an eye of sedate resolution, and something of an ironic wit lurking amid the wrinkles which age and thought had engraven on his face. I never saw so complete a transformation; and could hardly credit, that the bold, martial-looking, and courteous cavalier at my side had but an hour or two before sung rustic songs, and chaffered with the peasants of Cumberland, about the price of ends of ribbon and two-penny toys and trinkets. He seemed to understand my thoughts, and thus resolved the riddle in a whisper: —'Fair lady, these are not days when a knight of loyal mind may ride with sound of horn, and banner displayed, summoning soldiers to fight for the good cause; of a surety, his journey would be brief. In the disguise of a calling, low, it is true, but honourable in its kind, I have obtained more useful intelligence, and enlisted more good soldiers, than some who ride aneath an earl's pennon.'

"Our party, during this nocturnal march, had been insensibly augmented; and when the grey day came I could count about three hundred horsemen—young, well-mounted, and well-armed—some giving vent to their spirit or their feelings in martial songs; others examining and proving the merits of their swords and pistols, and many marching on in grave silence, forecasting the hazards of war and the glory of success Leaving the brown pastures of the moorlands, we descended into an open and cultivated country, and soon found ourselves upon the great military road which connects all the north country with the capital. It was still the cold and misty twilight of the morning, when I happened to observe an old man close beside me, mounted on a horse seemingly coeval with himself —wrapped, or rather shrouded, in a grey mantle, or plaid, and all the while looking steadfastly at me from under the remains of a broad slouched hat. I had something like a dreamer's recollection of his looks; but he soon added his voice, to assist my recollection, —and I shall never forget the verses the old man chanted with a broken and melancholy, and I think I may add, prophetic voice:

OH! PRESTON, PROUD PRESTON.

I.

Oh! Preston, proud Preston, come hearken the cry
Of spilt blood against thee, it sounds to the sky;
Thy richness, a prey to the spoiler is doom'd,
Thy homes to the flame, to be smote and consumed:
Thy sage with grey locks, and thy dame with the brown
Descending long tresses, and grass-sweeping gown,
Shall shriek, when there's none for to help them; the hour
Of thy fall is not nigh, but it's certain and sure.
Proud Preston, come humble thy haughtiness—weep—
Cry aloud—for the sword it shall come in thy sleep.

II.

What deed have I done—that thou lift'st thus thy cry,
Thou bard of ill omen, and doom'st me to die?
What deed have I done, thus to forfeit the trust
In high heaven, and go to destruction and dust?
My matrons are chaste, and my daughters are fair;
Where the battle is hottest, my sword's shining there;
And my sons bow their heads, and are on their knees kneeling,
When the pray'r is pour'd forth, and the organ is pealing:
What harm have I wrought, and to whom offer'd wrong,
That thou comest against me with shout and with song?

III.

What harm hast thou wrought! list and hearken—the hour
Of revenge may be late—but it's certain and sure:
As the flower to the field, and the leaf to the tree,
So sure is the time of destruction to thee.
What harm hast thou wrought!—haughty Preston, now hear—
Thou hast whetted against us the brand and the spear;
And thy steeds through our ranks rush, all foaming and hot,
And I hear thy horns sound, and the knell of thy shot:
The seal of stern judgment is fix'd on thy fate,
When the life-blood of Selby is spilt at thy gate.

IV.

Oh! Selby, brave Selby, no more thy sword's braving
The foes of thy Prince, when thy pennon is waving;
The Gordon shall guide and shall rule in the land;
The Boyd yet shall battle with buckler and brand;
The Maxwells shall live, though diminish'd their shine,
And the Scotts in bard's song shall be all but divine;
Even Forster of Derwent shall breathe for a time,
Ere his name it has sunk to a sound and a rhyme;
But the horn of the Selbys has blown its last blast,
And the star of their names from the firmament cast.

"I dropt the bridle from my hand, and all the green expanse of dale and hill grew dim before me. The voice of the old man had for some time ceased before I had courage to look about; and I immediately recognized in the person of the minstrel an old and faithful soldier of my father's, whose gift at song, rude and untutored as it was, had obtained him some estimation on the border—where the strong, lively imagery, and familiar diction of the old ballads, still maintain their ground against the classic elegance and melody of modern verse. I drew back a little; and shaking the old man by the hand, said, 'Many years have passed, Harpur Harberson, since I listened to thy minstrel skill at Lanercost; and I thought thou hadst gone, and I should never see thee again. Thy song has lost some of its ancient grace and military glee since thou leftest my father's hall.' ''Deed, my bonnie lady,' said the borderer, with a voice suppressed and melancholy, while something of his ancient smile brightened his face for a moment, 'sangs of sorrow and dule have been rifer with me than ballads of merriment and mirth. It's long now since I rode and fought by my gallant master's side, when the battle waxed fierce and desperate; and my foot is not so firm in the stirrup now, nor my hand sae steeve at the steel, as it was in those blessed and heroic days. It's altered days with Harpur Haberson, since he harped afore the nobles of the north, in the home of the gallant Selbys, and won the cup of gold. I heard that my bonnie lady and her gallant cousin were on horseback; so I e'en put my old frail body on a frail horse, to follow where I cannot lead. It's pleasant to mount at the sound of the trumpet again; and it's better for an auld man to fall with a sound of battle in his ear, and be buried in the trench with the brave, and the young, and the noble,—than beg his bread from door to door, enduring the scoff and scorn of the vulgar and sordid, and be found, some winter morning, streeked stiff and dead, on a hassoc of straw in some churl's barn. So I shall e'en ride on, andsee the lastof a noble and a hopeless cause.' He drew his hat over his brow; while I endeavoured to cheer him by describing the numbers, resources, and strength, of the party. And I expressed rather my hope, than firm belief, when I assured him 'there was little doubt that the house of Selby would lift its head again and flourish, and that the grey hairs of its ancient and faithful minstrel would go down in gladness and glory to the grave.' He shook his head, yet seemed almost willing to believe for a moment, against his own presentiment, in the picture of future glory I had drawn—It was but for a moment. ''Deed no—'deed no, my bonnie, bonnie lady, it canna—canna be. Glad would I be could I credit the tale, that our house would hold up its head again, high and lordly. But I have too strong faith in minstrel prediction, and in the dreams and visions of the night, to give credence to such a pleasant thought. It was not for nought that horemen rode in ranks on Soutra side last night, where living horseman could never urge a steed, and that the forms and semblances of living men were visible to me in this fearful procession. Nor was it for nought that my grandfather, old minstrel Harberson, caused himself to be carried in his last hour to the summit of Lanercost-hill, that he might die looking on the broad domains of his master. His harp—for his harp and he were never parted—his harp yielded involuntary sounds, and his tongue uttered unwilling words—words of sad import, the fulfilment of which is at hand. I shall repeat you the words: they are known but to few, and have been scorned too much by the noble race of Selby.

I rede ye, my lady—I rede ye, my Lord,
To put not your trust in the trumpet and sword;
To follow no banner that comes from the flood,
To march no more southward to battle and blood.
League not with Dalzell—no, nor seek to be fording
The clear stream of Derwent with Maxwell and Gordon,—
To a Forester's word draw nor bridle nor glaive,—
Shun the gates of proud Preston, like death and the grave—
And the Selbys shall flourish in life and in story,
While eagles love Skiddaw, and soldiers love glory.

"'These are the words of my ancestor—what must be, must—I shall meet thee again at the gates of Preston.' As he uttered these words he mingled with the ranks of horsemen under the banner of a border knight, and I rode up to the side of my cousin and his companion.

"It is not my wish to relate all I heard, and describe all I saw on our way southward; but our array was a sight worth seeing, and a sight we shall never see again—for war is now become a trade, and men are trained to battle like hounds to the hunting. In those days the noble and the gentle, each with his own banner,—with kinsmen and retainers, came forth to battle; and war seemed more a chivalrous effort than it seems now—when the land commits its fame and its existence to men hired by sound of trumpet and by beat of drum. It was soon broad daylight; all the adherents of the house of Stuart had moved towards Lancashire, from the south of Scotland and the north of England; and forming a junction where the Westmoreland mountains slope down to the vales, now covered the road as far as my eye could reach—not in regular companies, but in clusters and crowds, with colours displayed.—There might be, in all, one thousand horsemen and fifteen hundred foot, the former armed with sword and pistol, and carabine—the latter with musket and spear. It was a fair sight to see so many gentlemen dressed in the cavalier garb of other days, some with head and bosom pieces of burnished mail, others with slouched hats and feathers, and scarlet vests, and all with short cloaks or mantles, of velvet or woollen, clasped at the bosom with gold, and embroidered each according to their own or their mistress's fancy. A body of three hundred chosen horsemen, pertaining to my Lord Kenmore, marched in front, singing, according to the fashion of the Scotch, rude and homely ballads in honour of their leader.

I.

Kenmore's on and awa, Willie,
  Kenmore's on and awa,
And Kenmore's lord is the gallantest lord
  That ever Galloway saw.

II.

Success to Kenmore's band, Willie,
  Success to Kenmore's band;
There was never a heart that fear'd a Whig,
  E'er rode by Kenmore's hand.

III.

There's a rose in Kenmore's cap, Willie,
  There's a rose in Kenmore's cap,—
He 'll steep it red in ruddie life's blood,
  Afore the battle drap.

" Such were some of the verses, by which the rustic minstrels of those days sought to stimulate the valour of their countrymen. One hundred horse, conducted by Lord Nithsdale, succeeded; those of Lord Derwentwater followed; a band, numerous, but divided in opinion; unsteady in resolution, and timid in the time of need and peril, like their unfortunate lord. The foot followed: a band of warriors, strange, and even savage in their appearance; brave and skilful, and unblenching in battle, with plaid and bonnet and broadsword, bare-kneed, and marching to a kind of wild music, which, by recalling the airs of their ancestors, and the battles in which they fought and bled, kindles a military fury and resolution which destroys all against which it is directed. These were men from the mountains of Scotland, and they were led by chieftain Mackintosh, who was to them as a divinity; compared to whom, the prince, in whose cause they fought, was a common being, a mere mortal. I admired the rude, natural courtesy of these people, and lamented the coward counsels which delivered them up to the axe and the cord, without striking a single blow. The rear, accounted in this march, with an enemy behind as well as before, a post of some peril, was brought up by about two hundred border cavaliers and their adherents; and with them rode Walter Selby and his new companion. The command seemed divided among many; and without obeying any one chief in particular, all seemed zealous in the cause, and marched on with a rapidity regulated by the motions of the foot.

"No serious attempt was made to impede us: some random shots were fired from the hedge-rows and groves; till at length, after a fatiguing journey, we came within sight of Preston; and there the enemy made his appearance in large masses of cavalry and foot, occupying the distant rising grounds, leaving our entry into the town free and uninterrupted. Something in my face showed the alarm I felt on seeing the numbers and array of our enemies: this passed not unobserved of the cavalier at my side, who said with a smile, 'Fair lady, you are looking on the mercenary bands which sordid wealth has marched against us; these are men bought and sold, and who hire their best blood for a scarlet garb and a groat. I wish I had wealth enough to tempt the avarice of men who measure all that is good on earth by the money it brings. And yet, fair one, I must needs own, that our own little band of warriors is brought strangely together, and bound by ties of a singular kind. It would make a curions little book, were I to write down all the motives and feelings which have put our feet in the stirrup. There's my Lord Kenmore; a hot, a brave and a self-willed, and the Scotch maidens say a bonnie Gordon; his sword had stuck half-drawn from the scabbard, but for the white hand of his wife: but he that lives under the influence of bright eyes, Lady Eleanor, lives under a spell as powerful as loyalty. And what would the little book say of my Lord Nithsdale, with whom ride so many of the noble name of Maxwell? Can scorn for the continual cant and sordid hearts of some acres of psalm-singing covenanters, who haunt the hill tops of Terreagles and Dalswinton, cause the good lord to put the fairest domains on the border in jeopardy? Or does he hope to regain all the sway held by his ancestors of yore over the beautiful vale of Nith; humbling into dust, as he arises, the gifted weaver who preaches, the inspired cordwainer who expounds, and the upstart grocer who holds rule—the two former over men's minds, and the latter over men's bodies? There's my Lord Carnwath ———.'

"At this moment I heard the sounding of trumpets, and the rushing of horses behind us; and ere I could turn round, my cavalier said, in the same equal and pleasant tone in which he was making his curious communication of human character,—'Fair lady, here be strange auditors, some of my friend General Willis's troopers come to try the edges of their new swords. Halbert, lead this fair lady to a place where she may see what passes: and now for the onset, Walter Selby.' The latter, exchanging a glance with me, turned his horse's head; swords were bared in a moment; and I heard the dash of their horses, as they spurred them to the contest, while a Scottish soldier hurried me towards the town. I had not the courage to look back; the clashing of swords, the knelling of carabines, the groans of the wounded, and the battle-shout of the living, came all blended in one terrible sound—my heart died within me.

"I soon came up to the Scottish mountaineers, who, with their swords drawn, and their targets shouldered, stood looking back on the contest, uttering shouts of gladness, or shrieks of sorrow, as their friends fell or prevailed. I looked about, and saw the skirmish, which at first had only extended to a few blows and shots, becoming bloody and dubious; for the enemy, reinforced with fresh men, now fairly charged down the open road, and the place where they contended was soon covered with dead and dying. I shrieked aloud at this fearful sight; and quitting my horse's bridle, held up my hands, and cried out to the mountaineers, 'O haste and rescue, else they'll slay him! they'll slay him!' An old highlander, at almost the same instant, exclaimed in very corrupt English, '***! she'll no stand and see the border lads a' cut to pieces.' and, uttering a kind of military yell, flew off with about two hundred men to the assistance of his friends.

"I was not allowed to remain and witness the charge of these northern warriors, but was led into Preston, and carried into a house half dead, where several of the ladies, who followed the fortune of their lords in this unhappy expedition, endeavoured to soothe and comfort me. But I soon was the gayest of them all; for in came Walter Selby, and his companion, soiled with blood and dust, from helmet to spur. I leaped into my cousin's bosom, and sobbed with joy: he kissed my forehead, and said, 'Thank him, my Eleanor—the gallant knight, Sir Thomas Scott; but for him, I should have been where many brave fellows are.' I recovered presence of mind in a moment, and turning to him said, 'Accept, Sir, a poor maiden's thanks for the safety of her kinsman, and allow her to kiss the right hand that wrought this deliverance.' 'Bless thee, fair lady,' said the knight, 'I would fight a dozen such fields for the honour thou profferest, but my hand is not in trim for such lady courtesy; so let me kiss thine as a warrior ought.' I held out my hand, which he pressed to his lips; and washing the blood from his hands, removing the soils of battle from his dress, and resuming his mantle, he became the gayest and most cheerful of the company.

"It was evident, from the frequent and earnest consultations of the leaders of this rash enterprise, that information had reached them of no pleasing kind. Couriers continually came and went, and some of the chiefs began to resume their weapons. As the danger pressed, advice and contradiction, which at first were given and urged with courtesy and respect, now became warm and loud; and the Earl of Derwentwater, a virtuous and amiable man, but neither warrior nor leader, instead of overawing and ruling the tumultuary elements of his army, strode to and fro, a perfect picture of indecision and dismay, and uttered not a word.

"All this while Sir Thomas Scott sat beside Walter Selby and me, calm and unconcerned, conversing about our ancient house; relating anecdotes of the lords of Selby, in the court and in the camp; quoting, and, in his own impressive way of reciting verse, lending all the melody of music to the old minstrel ballads which recorded our name and deeds. In a moment of less alarm I could have worshipped him for this; and my poor Walter seemed the child of his companion's will, and forgot all but me in the admiration with which he contemplated him.

"The conference of the chiefs had waxed warm and tumultuous; when Lord Nithsdale, a little, high-spirited and intrepid man, shook Sir Thomas by the shoulder, and said, 'This is no time, Sir Knight, for minstrel lore, and lady's love; betake thee to thy weapon, and bring all thy wisdom with thee, for truly we are about to need both.' Sir Thomas rose, and having consulted a moment with Lord Kenmore, returned to us, and said, 'Come, my young friend, we have played the warrior, now let us play the scout, and go forth and examine the numbers and array of our enemies; such a list of their generals and major-generals has been laid before our leaders, as turns them pale; a mere muster-roll of a regiment would make some of them lay down their arms, and stretch out their necks to the axe. Lord Kenmore, fair Eleanor, who takes a lady's counsel now and then, will have the honour of sitting by your side till our return.' So saying, Walter Selby and Sir Thomas left us; and I listened to every step in the porch, till their return, which happened within an hour.

"They came splashed with soil, their dress rent with hedge and brake; and they seemed to have owed their safety to their swords, which were hacked and dyed to the hilts. The leaders questioned them, 'Have you marked the enemy's array, and learned aught of their numbers?' 'We have done more,' said Sir Thomas; 'we have learned from the tongues of two dying men, that Willis, with nine regiments of horse, and Colonel Preston, with a battalion of foot, will scarcely await for dawn to attack you.' This announcement seemed to strike a damp to the hearts of several of the chiefs; and, instead of giving that consistency to their councils which mutual fear often inspires, it only served to bewilder and perplex them. 'I would counsel you,' said Sir Thomas, 'to make an instant attack upon their position before their cannon arrive; I will lead the way; we are inferior in number, but superior in courage; let some of our border troopers dismount, and with the clansmen open a passage through Colonel Preston's troops which line the hedge rows and enclosures; the horse will follow, and there can be no doubt of a complete victory.' Some opposed this advice, others applauded it; and the precious hours of night were consumed in unavailing debate, and passionate contradiction.

"This was only interrupted by the sound of the trumpet, and the rushing of horse; for Willis, forcing the barriers at two places, at once made good his entry into the principal street of Preston. I had the courage to go into the street; and had not proceeded far till I saw the enemy's dragoons charging at the gallop: but their saddles were emptied fast, with shot, and with sword; for the clansmen, bearing their bucklers over their heads, made great havoc among the horsemen with their claymores, and at length succeeded in repulsing them to the fields. As soon as the enemy's trumpets sounded a retreat, our leaders again assembled; assembled not to conquer or fall like cavaliers, with their swords in their hands, but to yield themselves up to beg the grace of a few days, till they prepared their necks for the rope and axe. The highland soldiers wept with anger and shame, and offered to cut their way, or perish; but the leaders of the army, unfit to follow or fight, resolved on nothing but submission, and sent Colonel Oxburgh with a message to General Willis to propose a capitulation.

"Sir Thomas Scott came to Walter Selby and me, and said, with a smile of bitter scorn, 'Let these valiant persons deliver themselves up to strain the cord, and prove the axe; we will seek, Lady Eleanor, a gentler dispensation; retreat now is not without peril; yet let us try what the good green wood will do for poor outlaws; I have seen ladies and men too escape from greater peril than this.'

"We were in the saddle in a moment; and, accompanied by about twenty of the border cavaliers, made our way through several orchard enclosures, and finally entered upon an extensive common or chase, abounding in clumps of dwarf holly and birch, and presenting green and winding avenues, into one of which we gladly entered, leaving Preston half a mile behind. That pale and trembling light which precedes day began to glimmer; it felt intensely cold; for the air was filled with dew, and the boughs and bushes sprinkled us with moisture. We hastened on at a sharp trot; and the soft sward returning no sound, allowed us to hear the trumpet summons, and military din, which extended far and wide around Preston.

"As we rode along I saw Sir Thomas motion with his hand to his companions, feel his sword and his pistols, glance to the girths of his horse, and, finally, drop his mantle from his right arm, apparently baring it for a contest. In all these preparations he was followed by his friends, who, at the same time closed their ranks, and proceeded with caution and silence. We had reached a kind of road, half the work of nature, and half of man's hand, which divided the chase or waste in two; it was bordered by a natural hedge of of holly and thorn. All at once, from a thicket of bushes, a captain, with about thirty of Colonel Preston's dragoons, made a rush upon us, calling out, 'Yield! down with the traitors!' Swords were bare in a moment, pistols and carabines were flashing, and both parties spurred, alike eager for blood.

"Of this unexpected and fatal contest I have but an indistinct remembrance; the glittering of the helmets, the shining of drawn swords, the flashing of pistols and carabines, the knell of shot, the rushing of horses, and the outcry of wounded men, come all in confusion before me; but I cannot give a regular account of such a scene of terror and blood. It was of brief duration. I laid my bridle on my horse's neck, and wrung my hands, and followed with my looks every motion of Walter Selby. He was in the pride of strength and youth, and spurred against the boldest; and putting soul and might into every blow, made several saddles empty; I held up my hands and prayed audibly for success. A dragoon, who had that moment killed a cavalier, rode to my side, and exclaimed, 'Down with thy hands, thou cursed nun, down with thy hands; woot pray yet, woot thou; curse tha then;' and he made a stroke at me with his sword. The eyes of Walter Selby seemed to lighten as a cloud does on a day of thunder, and at one blow he severed the dragoon's head, bone, and helmet, down to his steel collar. As the trooper fell, a pistol and a carabine flashed together, and Walter Selbv reeled in the saddle, dropt his head, and his sword; and saying, faintly, 'Oh, Eleanor!' fell to the ground, stretching both his hands towards me. I sprang to the ground, clasped him to my bosom, which he covered with his blood, and entreated Heaven to save him; and oh, I doubt I upbraided the Eternal with his death! but Heaven will pity the ravings of despair. He pressed my hand faintly, and lay looking on my face alone, though swords were clashing, and pistols were discharged over us.

"Ere the contest had ceased, Sir Thomas sprang from his horse, took Walter Selby in his arms, and tears sparkled in his eyes, as he saw the blood flowing from his bosom. 'Alas! alas!' said he, 'that such a spirit, so lofty and heroic, should be quenched so soon, and in a skirmish such as this! Haste, Frank Elliot, haste, and frame us a litter of green boughs; cover it thick with our mantles; place this noble youth upon it, and we will bear him northward on our horses' necks. Ere I leave his body here, I will leave mine own aside it; and you, minstrel Harberson, bring some water from the brook for this fair and fainting lady.'

"All these orders, so promptly given, were as quickly executed; and we recommenced our journey to the north, with sorrowful hearts, and diminished numbers. I rode by the side of the litter, which, alas! became a bier, ere we reached the green hills of Cumberland. We halted in a lonely glen; a grave was prepared; and there, without priest, prayer, or requiem, was all that I loved of man consigned to a sylvan grave. 'The dust of our young hero,' said Sir Thomas, 'must lie here till the sun shines again on our cause, and it shall be placed in consecrated earth.' The minstrel of the ancient name of Selby stood gazing on the grave, and burst out into the following wail or burial-song, which is still to be heard from the lips of the maids and matrons of Cumberland:

LAMENT FOR WALTER SELBY.

I.

Mourn, all ye noble warriors—
 Lo! here is lying low
As brave a youth as ever
 Spurr'd a courser on the foe:
Hope is a sweet thing to the heart,
 And light unto the ee,
But no sweeter and no dearer
 Than my warrior was to me:
He rode a good steed gallantly,
 And on his foes came down
With a war-cry like the eagle's,
 From Helvellyn's haughty crown:
His hand was wight, and his dark eye
 Seem'd born for wide command;
Young Selby has nae left his like
 In all the northern land.

II.

Weep for him, all ye maidens—
 And weep for him, all ye dames;
He was the sweetest gentleman
 From silver Tweed to Thames.
Wail all for Walter Selby,
 Let your tears come dropping down;
Wail all for my young warrior,
 In cottage, tower, and town.
Curs'd be the hand that fired the shot;
 And may it never know
What beauty it has blighted,
 And what glory it laid low!
Shall some rude peasant sit and sing,
 How his rude hand could tame
Thy pride, my Walter Selby,
 And the last of all thy name?

III.

And mourn too, all ye minstrels good,
 And make your harp-strings wail,

And pour his worth through every song,
His deeds through every tale.
His life was brief, but wond'rous bright:
Awake your minstrel story!
Lo! there the noble warrior lies,
So give him all his glory.
When Skiddaw lays its head as low,
As now 'tis green and high—
And the Solway sea grows to a brook,
Now sweeping proudly by—
When the soldier scorns the trumpet sound,
Nor loves the temper'd brand—
Then thy name, my Walter Selby,
Shall be mute in Cumberland.

"But, alas! the form of the lovely and the brave was not permitted to sink silently into dust—it was plucked out of its lonely and obscure grave—displayed on a gibbet, and the head, separated from the body, was placed on the gate of Carlisle. All day I sat looking, in sadness and tears, on this sorrowful sight, and all night I wandered wild and distracted about, conjuring all men who passed by to win me but one tress of the long bright hair of Walter Selby. Even the rude sentinels were moved by my grief, but no one dared to do a deed so daring and so perilous.

"I remember it well—it was on a wild and stormy night—the rain fell fast—the thunder rocked the walls, and the lightnings flashing far and wide shewed the castle's shattered towers, and the river Eden rolling deep in flood. I wrapped my robe about me, and approached the gate. The sentinels, obeying the storm, had sought shelter in the turrets, and no living soul seemed abroad but my own unhappy self. I gazed up to the gate where, alas! I had often gazed, and I thought I beheld a human form—a flash of lightning passed, and I saw it was a living being—it descended and approached me, motioning me back with its hand. I retired in awe, and still the figure followed. I turned suddenly round and said, 'Whether thou comest for evil or for good, farther shall I not go till I know thy errand.'

"'Fair and unhappy lady,' said a voice which I had often heard before, 'I have come, not without peril, from a distant place; for I heard the story of your daily and nightly sorrowings, and I vowed not to leave a relique of the noble and the brave to gladden the eyes of vulgar men, and feast the fowls of heaven. Here, take this tress of thy lover's hair, and mourn over it as thou wilt—men shall look on the morrow for the golden locks of Walter Selby waving on Carlisle gate, and when they see nothing there they shall know that the faithful and the valiant are never without friends. His body has been won, and his head removed, and his dust shall mingle with the knightly and the far descended, even as I vowed when we laid him in his early grave.' With these words Sir Thomas Scott departed, and I placed the ringlet in my bosom, from which it shall never be separated."

Such was the story of Eleanor Selby. In a latter day some unknown Scottish minstrel heard the uncertain and varying tradition, and, with a minstrel's licence, wove it into verse, suppressing the name of Selby and giving the whole a colour and character most vehemently Scottish. A northern lady is made to sing the following rude and simple lament:

CARLISLE YETTS.

White was the rose in my love's hat,
While he rowed me in his lowland plaidy,
His heart was true as death in love,
His hand was ay in battle ready;
His lang lang hair in yellow hanks
Waved o'er his cheeks so sweet and ruddy,
But now it waves o'er Carlisle yetts,
In dripping ringlets soiled and bloody.

II.

When I came first through fair Carlisle
Ne'er was a town sae gladsome seeming,
The white rose flaunted o'er the wall,
The thistled pennons far were streaming.
When I came next through fair Carlisle
O! sad, sad seemed the town and eerie,
The old men sobbed, and grey dames wept,
O! lady, come ye to seek your dearie?

III.

I tarried on a heathery hill,
My tresses to my cheeks were frozen,
And far adown the midnight wind
I heard the din of battle closing.

The grey day dawned, where 'mang the snow
  Lay many a young and gallant fellow,
But the sun came visiting in vain
  Two lovely een tween locks of yellow.

IIII.

There's a tress of soiled and yellow hair
  Close in my bosom I am keeping,
Oh! I have done with delight and love,
  So welcome want, and woe, and weeping.
Woe, woe upon that cruel heart,
  Woe, woe upon that hand so bloody,
That lordless leaves my true love's hall,
  And makes me wail, a virgin widow.

THE SLIDE OF ALPNACH.

(Concluded from page 222.)

"From the phenomena just described, I have deduced several conclusions, of which at present I can only give a very general account, without entering into any of the mathematical reasonings on which they rest.

"1. The rapidity of the descent is so extraordinary, it is so much greater than any thing that could have been anticipated, exceeding that of a horse at full speed, nearly in the ratio of 3 to 2, that the account seems to tread on the very verge of possibility, and to touch the line that divides between what *may*, and what *cannot* exist. The same question, therefore, I have no doubt, has occurred to many that occurred to myself, when I first heard of this extraordinary phenomenon.

"Is it possible that even if there were no friction, and if a body was accelerated along the line of swiftest descent, from a point 2500 feet above another, and horizontally distant from it by 44,009, that it could arrive at that lower point in three or even in six minutes? This was the first question that occurred to me, and at a distance from books as I was then, and in no condition to undertake any nice or difficult calculation, I could only satisfy myself by a rude approximation, that there was nothing in the reported circumstance that was without the limits of possibility. Had the result of the calculation been contrary, I should not only have disbelieved the report, but I should have doubted the testimony of my own senses.

" From a more accurate calculation I find, that if no friction nor resistance took place, and if the moving body was allowed to take its flight in the line of the swiftest descent, that it would do so in less than sixty-six seconds. This is the minimum then of time, and we may rest assured, while the laws of nature continue the same that they are now, that no body, in the circumstances just described, can perform its journey in less time than the above.

" But though the descent of the trees at Alpnach contains nothing inconsistent with the acceleration of bodies by gravity, it is not to be reconciled with the notions concerning friction, that are usually received even in the scientific world.

" It is common to consider friction as a force bearing a certain proportion to the weight of the body moved, and as retarding the body by a force proportional to its weight, amounting to a fourth or fifth part, or when least to a tenth or twelfth part of gravity. A body, therefore, that was descending along an inclined plane, would be accelerated by its own gravity, minus the force of friction, a constant force that increased in proportion to the body.

" Now, in the present case, it will soon appear, that the retardation is vastly less than would arise from any of these suppositions.

" Supposing it to be true, that friction in a given instance (the surface, the inclination, and the weight being all given,) acts as a uniformly retarding force, I have found that a body sliding along an inclined surface, under the acceleration of gravity, and the retardation of friction, will be accelerated, so that it will have at every point the velocity that would be acquired by falling by its own gravity from a line inclined to the horizon, that is drawn from the point where the body began to move, and that makes with the horizon an angle, the tangent of which is the fraction, that denotes the ratio of friction to gravity. The velocity of the moving body is therefore as the square root, of the portion of a vertical passing through the body, and reaching up to the line just mentioned, or the line of no acceleration.

"As the trees of Alpnach enter the lake with a considerable velocity, it is evident, that the line of no acceleration, drawn from the top of the slide, does not reach the ground at the point where the slide ends; but is then still considerably above the surface; the tangent, therefore, of the angle which that line makes with the horizon, is much less than $\frac{1}{17}$. There is reason to think that it does not in reality amount to $\frac{1}{3}$ of this, and is therefore less than $\frac{1}{50}$. It follows, then, that the friction that trees suffer in the slide is less than one-fiftieth of their weight.

"Now, from what can we suppose the small proportion that friction, in this instance, bears to the weight, to arise? It is not that the surfaces have a great smoothness or a fine polish. The logs that form the trough are coarsely dressed with the adze, and I observed that there was not even the precaution taken of making the grain of the wood lie downwards, or toward the declivity. It was so in the tree, but not in the trees which composed the slide. It is not that that any lubricating substance, oil, grease, soap, or black-lead, is interposed between their surfaces. Water is the only substance of this kind that is applied. We have fir rubbing on fir, which is supposed a case remarkably unfavourable to the diminution of friction. It can only arise, therefore, from a principle that some mechanical writers have suspected to exist, but which was never before, I think, proved by the direct evidence of facts, namely, that the force of friction does not increase in the proportion of the weight of the rubbing body, so that heavy bodies are, in reality, less retarded in their motion on an inclined surface than lighter bodies. Thus, the whole of the phenomena I have been describing, tend to prove, especially the fact I mentioned, that heavy trees made their way more easily than light ones, and that a tree must be of a certain magnitude to make its way to the bottom. Friction, therefore, does not bear even in the same materials a given ratio to the weight, but a ratio that evidently decreases as the weight increases; so that, in a fir of ordinary size it is $\frac{1}{10}$ or $\frac{1}{20}$, in one of 100 feet in length it is between $\frac{1}{50}$ and $\frac{1}{60}$. According to what law this change takes place, it would be most useful to investigate; it is an inquiry for those engineers who have strong machinery and great power ready at command.

"I must observe also, that I strongly suspect that friction diminishes with the velocity of the moving or sliding body. That it passes all at once when a body begins to move, to be only half of what it was when the body was at rest, is quite certain, and is proved by many experiments. It seem to me not unlikely, that the same progress continues as the motion becomes greater. Perhaps in as much as friction is concerned, the pressure is lessened by the velocity, and the poet was not so far mistaken as he is generally supposed to be, when he said of his heroine,

Illa vel intactæ segetis per summa volaret
Gramina, nec teneras cursu læsisset aristas.*

However that be, we have a strong example here of the danger of concluding in many of the researches of mechanics, from experiments made on a small scale to the practice that is to be proceeded on in a great one. It requires some attention to enable us to discriminate between the cases where we can safely proceed from the small to the great, and those in which we cannot. A man, from finding that bodies of a pound or half a pound are in equilibrio where their distances from the fulcrum are inversely as their weights, might, without danger of error, transfer the conclusion to weights of hundreds of tons, or to whole planets, were it possible to make the experiment on so large a scale. But when he finds, that the friction of a body of a pound, or a hundred weight, is one-fourth of the weight, he cannot, with equal safety, presume that the same will hold when bodies of immense weight and size come to rub against one another. There are many other cases of the same kind. In general, when our experiments lead to the knowledge of a fact and not of a principle, there is caution required in extending the conclusions beyond the limits by which the experiments have been confined. This is the case with the experiments on friction, where we know only facts, and have no principle to guide us; that is, we have not been able to connect the facts with any of the known and measurable properties of body. In the case of the lever, we have connected the fact with the inertia of matter, and the equality of action and re-action. We have, therefore, a right to repose confidence on the one, when extended, though not on the other.

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* Not so when swift Camilla scours the plain,
Flies o'er th'unbending corn, and skims along the main.

" That friction belongs to the cases in which great caution is necessary in extending the conclusions of experiments, is indeed most strongly evinced by the operations that have now been described, the result of which is such as could not have been anticipated from those experiments. The danger here, however, is quite of an opposite kind from that which commonly takes place in such instances. The experiments on the small scale, usually represent the thing as more easy than it is upon the great, and engage us in attempts that prove abortive, and are followed by disappointments and even ruin. In the present case, the experiments on the small scale represent the thing as more difficult than when tried on a great one it is found to be, and would lead us, by an error, the direct opposite of the last, to conclude things to be impracticable that may be carried into effect with ease. Had the ingenious inventor of the slide at Alpnach been better acquainted with the received theories of friction, or the experiments on which they are founded, even those that are the best, and on the greatest scale, such as those of another most skilful engineer, M. Coulomb, or had he placed more faith in them, he would never have attempted the great work in which he has so eminently succeeded."

On the preceding deductions of the deceased Professor, Dr. Brewster has appended the following very important remarks, which, from their relation to several questions that have been inserted in this Miscellany, we have been induced to transcribe :

" It is much to be regretted that the editor of Professor Playfair's works did not terminate the preceding interesting and valuable paper with the second paragraph of p. 298. In the succeeding pages, the distinguished author maintains, 1. That the phenomena of the slide are incompatible with the recent theories of friction. 2. That Mr. Rupp, the engineer, would never have executed that great work, had he been acquainted either with these theories, or with the experiments of Coulomb. 3. That heavy bodies are less retarded by friction on an inclined plane than lighter bodies; and, 4. That he strongly suspects that friction diminishes with the velocity of the moving or sliding body. The two first of these conclusions are evidently incorrect, and founded on an oversight of the author; and the two last have long formed a part of the received theories on friction, and have been deduced from actual experiment.

" On the evening upon which Professor Playfair read this paper to the Royal Society, the writer of this note reminded him of Coulomb's beautiful discovery, that when the touching surfaces were small compared with the pressure, (which was obviously the case with the trees of Alpnach,) *the friction diminished as the velocity increased*; and in our brief notice of the paper in Vol. I. p. 193. of this Journal, published during Mr. Playfair's life, we remarked, 'that the very singular phenomena described in Mr. Playfair's paper, arose from the diminution of friction in consequence of an increase of velocity, and may be regarded as an experimental confirmation, on a large scale, of the ingenious views of Coulomb.' That Mr. Playfair intended to avail himself of these hints, was quite certain, as he repeatedly declined to print the paper in the Transactions of the Royal Society of Edinburgh, till he had matured his views on the subject.

" M. Bossut, so early as the year 1763, had discovered that the friction was always a less part of the pressure in large masses than in small ones; and had thus in some measure anticipated the discovery of Coulomb. Some time afterwards M. Lambert observed, that the resistance generated by the friction of the communicating parts of an undershot corn-mill, combined with that which arises from the grain between the mill-stones, always diminished when the velocity was increased; and Mr. Southern, of Soho, found, by experiments on heavy machinery, that the friction never exceeded $\frac{1}{40}$th of the pressure, which is even less than its average amount in the slide of Alpnach.

" We have been induced to make these observations, in order to shew that the phenomena of the slide of Alpnach were in every respect consistent with previous theories and experiments, and to prevent any doubtful opinions from being propagated under the sanction of a distinguished name."

SCIENTIFIC INFORMATION.

Sir Robert Seppings, in his letter to Lord Melville, has most unquestionably demonstrated two essential and important principles, namely, *1st*, That a ship's stern, when constructed of a square form, is weak and feeble, when compared with the present general structure of the vessel; and *2dly*, That vessels with sterns of the same form, are incapable of making a strong and vigorous defence, when attacked by a powerful force in that part; but that vessels with circular sterns possess qualities and powers precisely the reverse, exhibiting strength where weakness is invariably found in the old form, supplying all the defects attendant on that mode of construction, giving strength to the entire mechanical frame of the ship, and affording increased security and power to the gallant men who navigate and defend her.

In Mr. Lumsdaine's Report on the Cultivation of Spices, it is said: Upon an average, the nutmeg-tree produces fruit at the age of seven years, and increases in produce till the fifteenth year, when its productiveness is at the highest. It is said to continue prolific in the Moluccas for seventy or eighty years, but our experience carries us no farther than twenty-two years and a half, all the trees of which age that have been properly managed, are still in the highest degree of vigour and fecundity; and for this reason no term for planting a succession of trees can yet be fixed upon. Seven months in general elapse between the first appearance of the blossom and ripening of the fruit, and the produce of one bearing tree with another under good cultivation, may, in the fifteenth year of the plantation, be calculated at five pounds of nutmegs, and a pound and a quarter of mace. I have observed, however, that some trees produce every year a great quantity of fruit, while others constantly give very little. It bears all the year round, but more plentifully in some months than in others. The great harvest may generally be looked for in the months of September, October, November, and December, and a small one in April, May, and June. Like other fruit trees on this portion of Sumatra, I have remarked that it yields most abundantly every second year. The fruit having ripened, the outer integument bursts spontaneously, and is gathered by means of a hook attached to a long stick, and the mace being cautiously stripped off, and flattened by the hands in single layers, is placed on mats for three or four days in the sun to dry.

M. Arago has transmitted to the French Academy of Sciences, an account of an observation he had made, which proves that the recent earthquake, the shocks of which were felt at Lyons and its neighbourhood, also extended its action to Paris. M. Arago has an observatory at Paris, for the purpose of observing the variations of the magnetic needle. On the 19th February, the needle remained perfectly steady until half-past eight o'clock; at a quarter before nine, it became agitated in a very extraordinary manner, with an oscillatory motion in the direction of its length. On observing this truly singular phenomenon, M. Arago was of opinion that it was occasioned by an earthquake.—At the same day and hour, M. Biot remarked an oscillating movement produced by the same earthquake, at his own residence in the College de France.

M. de Clinchamp, teacher of the youth intended for the marine service at Toulon, in France, has invented an instrument called a Hyalograph, which takes off, with extreme correctness, the appearances of natural objects. A particular sort of ink serves to impress on paper designs taken on the glass of the instrument; and as the first impression cannot be erased, many proofs may be taken off, by inking it over again. The hyalograph serves also for many mathematical applications. The works executed with hyalographic ink have the appearance of lithrographic designs.

Eggs may be preserved, according to M. Cadet, a great length of time in lime-water containing excess of lime. An excellent mode of preserving them also, is to place them for about 20 seconds in barley-water; then remove, dry, and put them by. Eggs may be well salted throughout, if laid in brine for 8 or 10 days, and may then be preserved a great length of time.

Mr. Forster has shewn, that caoutchouc bottles may be expanded, until so thin and large as to answer many purposes of bladders, in philosophy and the arts His process is to condense air into the caoutchouc, which gradually forms the appearance of a blister at the bottom of the bottle, and which, extending, at last includes the whole. In this way the bottles have been made 6 or 7 inches in diameter; and by care, Mr. F. thinks, may be made thin enough for balloons. When rubbed on warmed paper, these globes of Indian Rubber become very strongly electrical.—*Phil. Mag.* lix, 263.

M. Bourdet, an ex-captain in the French service, has described, in a letter, a very singular electrical phenomenon which he witnessed in Poland, Dec. 24, 1806. The weather, according to the Poles, had never been milder at that season of the year, no snow had been seen, nor had the usual cold weather of the north, which generally sets in early in that country, then commenced. Rains and storms, however, were frequent. "I was," says M. Bourdet, "with the advanced guard of light-cavalry; the commander gave me an order to halt in the rear and see that my guns were disembarassed, and then to rejoin, as quickly as possible, the light brigade. In spite of the efforts of my men, the guns were not cleared from the marshy ground in which they were entangled, without great labour. We were advancing across the field about nine o'clock in the evening, when a strong gust of wind suddenly arose, (the sun had shone brightly during the day,) and in a few minutes after, the night became so dark, that we could not see the heads of our horses. The wind blew so violently, that the horses stopped. At that moment the extremity of the hair on their ears became luminous, as well as all the longer hairs on their bodies, except the locks on their manes and tails. All the metallic extremities of their harness, and all the metallic sharp points of the carriages of our guns, were studded with luminous points, so that one might have supposed, had it been Spring, that a swarm of glow-worms had covered our horses and guns. Our quarter-master observed that the points of my mustachios were luminous. The same phenomenon was seen on some of the cannoneers, but none of us had our eye-lashes or hair rendered luminous. These lights remained as long as the gust of wind lasted, namely, for three or four minutes. Their colour was a soft violet, and they terminated in a bright white. The horses held their heads high, their ears were erect and moving, their nostrils open and respiring, their manes and tails erected, their fore-legs thrown forward, and their hind ones back. Their attitude, in general, was that of animals seized with terror. During the time the wind blew, they remained at full stop, and when feeling the spur, some stood stock still, and others kicked, as if they had been reluctant to advance. When the wind ceased, the lights disappeared, and a deluge of rain, mingled with hail, fell. But though the obscurity continued, our horses moved on, shaking themselves at times, panting forcibly, and neighing; but they continued on their march. On arriving at the advanced post, I mentioned to my comrades the phenomenon we had witnessed, and though they had been only three leagues from us, they had felt no wind, but experienced much rain. The wind we encountered, had an opposite direction to the rain."

ANSWERS

TO THE

QUESTIONS FOR YOUTH,

Proposed in the Third Number of the Fourth Volume.

(1) *By* Master *Ralph Spofforth.*

To find the time of the day, when the square of the time from noon, added to the cube of the time to midnight, is a maximum.

By Master Henry Sim.

Let x represent the time to midnight: then $12 - x$ $=$ time from noon; by the question $(12 - x)^2 + x^3$ $= 144 - 24x + x^2 + x^3 =$ a maximum: In fluxions $-24\dot{x} + 2x\dot{x} + 3x^2\dot{x} = 0$; by division and transposition $x^2 + \frac{2}{3}x = 8$; solved, it gives $x = \frac{1}{3}\sqrt{73} - \frac{1}{3}$ $=$ 2h. 30′ 52$\frac{12}{13}$″; hence 12 − 2h. 30′ 52$\frac{12}{13}$″ = 9h. 29′ 7$\frac{1}{13}$″. p.m., the time of the day required.

By the Proposer.

Put $x =$ the time from noon, and $a =$ 12h.; then $a - x =$ time to midnight, and $x^2 + (a - x)^3 =$ a min.: In fluxions $2x\dot{x} - 3\dot{x}(a - x)^2 = 0$, or $3(a - x)^2 = 2x$; $\therefore x = \frac{3a + 1 - \sqrt{(6a + 1)}}{3} = \frac{37 - \sqrt{73}}{3} = 9.48533 =$ 9h. 29m. 7sec. from noon.

The question is printed for a maximum, but it ought to be a minimum.

(2) *By* Master *W. Tillotson*.

Find three harmonical means between *a* and *b*.

By Master R. Spofforth.

Let x represent one harmonical mean between a and b; then $a : b :: a - x : x - b$, and $x = \frac{2ab}{a+b}$. In like manner an harmonical mean between a and $\frac{2ab}{a+b}$ will be found equal to $\frac{4ab}{a + 3b}$, and between $\frac{2ab}{a+b}$ and $b = \frac{4ab}{3a + b}$; hence the three harmonical means are $\frac{4ab}{a + 3b}$, $\frac{2ab}{a+b}$, and $\frac{4ab}{3a + b}$.

Cor. If n represent any odd number of means between a and b, the means themselves will be $\frac{(n + 1)ab}{a + nb}$, $\frac{(n + 1)ab}{2a + (n - 1)b}$, $\frac{(n + 1)ab}{3a + (n - 2)b}$, &c.

By Master Henry Sim.

The three arithmetical means between $1 \div a$ and $1 \div b$, are readily found to be $\frac{a + 3b}{4ab}$, $\frac{a + b}{2ab}$, and $\frac{3a + b}{4ab}$: now, since the reciprocals of any arithmetical series are in harmonical proportion, it is evident that $\frac{4ab}{a+3b}$, $\frac{2ab}{a+b}$, and $\frac{4ab}{3a+b}$ will be the three required means between a and b.

(3) *By* Master *W. Hattersley.*

From a cylindrical piece of lead, 4 yards long and 2 feet in diameter, a solid yard is to be cut off: what will be the length of the remaining frustum?

By Masters H. Ward and J. Sirrah.

$.7854 \times 2^2 = 3.1416$ area of the base; and $27 \div 3.1416 = 8.59434$ length cut off. Therefore $12 - 8.59434 = 3.40566$ length of the remaining frustum.

By Master William Jackson.

First $2^2 \times {\cdot}7854 \times 12 = 37{\cdot}6992$ the solidity of the cylinder, then $37.6992 - 27 = 10.6992$ the solidity of the remaining frustum, and $10.6992 \div 2^2 \times .7854 = 3.4056$ feet the length required.

(4) *By* Master *R. Pattison.*

Being one day on the top of a castle, I dropped a stone down, and observed, that it was just 10 sec. between the stone leaving my hand and the sound which it made at the bottom reaching my ear: find the height of the castle.

By Master W. R. Bennett.

Put $x =$ height of the Castle, $16\frac{1}{12} = a$, and $1142 = b$, then per Nat. Phil. $\sqrt{a} : 1'' :: \sqrt{x} : \sqrt{(x \div a)} =$ time of the stone's falling to the ground, and since sound moves uniformly: $1'' :: x : x \div b =$ time of the sound's ascending to the top of the castle. $\therefore x \div b + \sqrt{(x - a)} = 10''$, or $x + \sqrt{x} = 10'' \times 1142 \times 16\frac{1}{12}$ which reduced gives $x = 1270$ feet $=$ height of the castle.

(5) *By* Master *Jonathan Horner.*

Given $(x^3 + by^2)^{\frac{1}{2}} = ax$, to find y a maximum.

By Master J. Horner.

By squaring, $x^3 + by^2 = a^2x^2$, in fluxions, $3x^2x^{\cdot} + 2byy^{\cdot} = 2a^2xx^{\cdot}$; but when y is a max., $y^{\cdot}$ is nothing; $\therefore 3x^2x^{\cdot} = 2a^2xx^{\cdot}$, divide by $xx^{\cdot}$, and $3x = 2a^2$, or $x = 2a^2 \div 3$, substitute this value of x in the first equation, and we get $\frac{8a^6}{27} + by^2 = \frac{4a^6}{9}$, or $by^2 = \frac{4a^6}{9} - \frac{8a^6}{27} = \frac{4a^6}{27}$ $\therefore y^2 = \frac{4a^6}{27b}$, or $y = \overline{\frac{4a^6}{27b}}\Big|^{\frac{1}{2}} = 2a^3 \div 3\sqrt{3b}$.

(6) *By* Master *John Macauley.*

Given $xy + \sqrt{(x^2 + y^2)} = 17$, and $x - y = 1$, to find x and y, by quadratics.

By Master Charles Macauley.

By transposing and squaring the first and taking the square of the second from it, we get $x^2y^2 - 36xy = -288$. Com. the □ and taking the root we get $xy - 18 = \pm 6$, (in this case -6) and $xy = 12$: hence having given the product and difference, a well-known problem, the numbers are easily found $= 3$ and 4.

(7) *By* Master *Benjamin Sigston.*

Given $x^2 + y^2 = 41$, and $x^3 + y^3 = 189$, to find x and y.

By Master F. Forster.

Let $w + z$ be the greater and $w - z$ be the less number. Then $(w + z)^2 + (w - z)^2 = 2w^2 + 2z^2 = 41$; also $(w + z)^3 + (w - z)^3 = 2w^3 + 6wz^2 = 189$. Now by subtracting the latter from the former multiplied by $3 \times w$ we have $4w^3 = 123w - 189$, or $4w^3 - 123w + 189 = 0$. Whence, by a few trials or Cardan's Rule, we find $w = 4.5$, and $z = .5$: therefore $w + z = 5$, and $w - z = 4$, the numbers reqd.

(8) *By* Master *J.* LENS.

What was the length of the day in the year 1821, at Ploughill, lat. 50 deg. 56 min. North, when the inhabitants had the shortest twilight?

By Master J. HORNER.

In *Keill's Lectures on Astronomy* we have the following analogy to find the declination of the sun at the time of shortest twilight; As rad. : tang. 9° :: sin. 50° 56′ : sin. 7° 3′ = the declination; ∵ to find the ascensional difference we have given in a right-angled spherical △, the ∠ at the base = the co-lat. 39° 24′ and the opposite side = 7° 3′ to find the adjacent side: Therefore by the 8th case of right-angled spherical △s in *Emerson's Trigonometry*, as rad. : co-t. 39° 4′ :: tang. 7° 3′ : sin. 8° 46′ = the ascensional diff., which converted into time = 35m. Therefore the sun rises 6h. 35m., and sets 5h. 25m.: conseq. the length of the day is 10h. 50m.

By Master WILLIAM JACKSON, *and the Proposer.*

First, as rad. : tang. 9° :: sin. lat. 50° 56′ : sin. decl. 7° 3′ 49″ S. when the twilight is the shortest, and as rad. : tang. declin. 7° 3′ 49″ :: tang. lat. 50° 56′ : cos. of angle at the pole at the time of sun rising 81° 13′ 10″; then as 15° : 1h. :: 2(81° 13′ 10″) : 10h. 49m. 45s. the length of the day required.

All the questions were answered by Masters C. Macauley, W. R. Bennett, H. Ward, R. Spofforth and H. Sim.

Master J. Horner answered 1, 3, 5, 6, 8.

——— J. Forster answered 1, 2, 3, 4, 6, 7.

——— J. Sirrah answered 3, 7, 8.

——— W. Jackson answered 5, 4, 8.

ANSWERS

TO THE

MATHEMATICAL QUESTIONS

Proposed in the Third Number of the Fourth Volume.

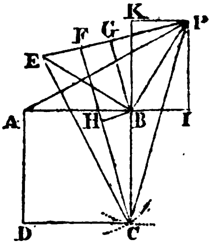
Six numbers of the Leeds Correspondent are now, and will be hereafter, regularly offered as a prize, to be adjudged BY LOT, to one Gentleman out of those who may give true solutions to the Prize Question in each number.

Mr. Bronwin, who has answered the Prize Question in this Number, and on whom the lot fell, will have the goodness to apply, either personally or by letter, to Mr. John Heaton, Bookseller, Briggate, Leeds, and he will receive six copies of this Number gratuitously, as allotted to him.

(261) *By* PLUS MINUS.

The three distances of an oak from the three visible corners of a square field are known to be 5, 4, and 6 chains respectively: It is required to determine geometrically the area of the field.

By the Proposer, and MESSRS. C. HOLT *and* W. SHEPHERD.



CONSTR. Take PB equal to one of the given distances as 4, and draw BE perpendicular and equal to PB: about the centres E, P, with the radii EC = 5, and PC = 6, describe arcs intersecting in C: then BC, when drawn, is the side of the square required.

DEM. For completing the □ and joining AP, the △s EBC, PBA, will be equal in all respects, since the two sides EB, BC in the one, are equal to the two PB, BA in the other, and the included $\angle$s EBC, ABC are equal, because EBP, ABC are equal, each being a right angle; and ABE is common to both, therefore EC $=$ AP, or AP, BP, CP are the given distances, per constr. Q.E.D.

Comp. Draw CF, BG perpendicular, and BH $\parallel$ to EP: then EP $= 4\sqrt{2} = 5.6568$, BG $=$ FH $= 2.8284$, FG $=$ BH $= 11\sqrt{2} \div 16$, PF $= \frac{43}{16}\sqrt{2}$, FC $= \sqrt{(PC^2 - PF^2)} = 4.6427$, CH $= 1.8143$; whence $BC^2 = CH^2 + BH^2 = 4.2369$sq.ch. 1r. $27\frac{3}{4}$p. the area of the square in this case; but if the point P be within the square, the content required comes out 5a. 2r. 28p.

An Analytical Solution,—by Plus Minus *and* Mr. John Baines.

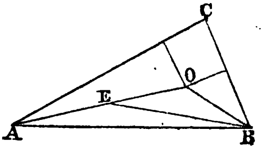
Draw PI, PK, perpendicular to AB, BC, then putting $a = 5^2 - 4^2 = 9$, $d = 6^2 - 4^2 = 20$, $c = 4$, and $x =$ AB, we have BI $= (a - x^2) \div 2x$, and BK $= (d - x^2) \div 2x$: Whence per Euc. 47, 1, $(a - x^2) + (d - x^2)^2 \div 4x^2 = c^2$: hence putting $s = \frac{1}{2}(a + d + 2c^2)$ we get $x^2 = s \pm \sqrt{[s^2 - \frac{1}{2}(a^2 + d^2)]} = 56.76309$ or 4.23691 chains, or 5a. 2r. 28p. and 1r. $27\frac{3}{4}$p.

(262) *By the same.*

Given the hypothenuse of a right angled plane triangle (10) and the difference of two right lines drawn from the extremities of the hypothenuse to the centre of the inscribed circle (2) to determine the sides by a single equation.

N. B. This question is solved in Bonnycastle's Algebra by a complex quadratic equation.

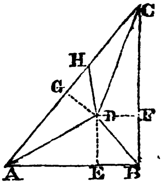
By Plus Minus *and* Mr. James Jerwood.



Let ACB be the reqd. $\triangle$, O the centre of its inscribed circle, AO, BO the lines having the given difference AE $= 2$: then, since the $\angle$ at C is a right one, AOB $= \frac{3}{2}$ of a right

$\angle$, or 135°; and because OE = OB, we have $\angle$ OEB = OBE = 22° 30′, or in the $\triangle$ AEB, are given two sides and an angle opposite to one of them; viz. AB = 10, AE = 2, and the $\angle$ AEB = 157° 30′, to find the $\angle$ ABE = 4° 23′ 22½″, to which add the $\angle$ OBE = 22°30′, and double the sum gives the $\angle$ ABC = 53° 46′ 45″. Whence AC = 8.067 and BC = 5.909.

By Mr. John Baines.



Let ABC be the required $\triangle$, and D the centre of the inscribed circle. Put AC = a = 10, CD + AD = $2x$, and CD − AD = $2b$ = 2; then CD = $x + b$, and AD = $x - b$; and ABC being a right angle, and the lines CD, AD bisecting the $\angle$s ACB, CAB, the $\angle$ ADC = 135°, and its co-sine = $-\frac{1}{2}\sqrt{2}$. Now (Prop. xvii, p. 19, *Gregory's Trigonometry*,) $2(x+b).(x-b) : (x+b)^2 + (x-b)^2 - a^2 :: 1 : -\frac{1}{2}\sqrt{2}$, which being reduced gives $x^2(2+\sqrt{2}) = a^2 - b^2(2-\sqrt{2})$, or $x = \sqrt{\left\{\dfrac{a^2 - b^2(2-\sqrt{2})}{2+\sqrt{2}}\right\}} = \sqrt{(97 - 48\sqrt{2})} = 5.396086$; hence AD = 4.396086 and CD = 6.396086. But $CD^2 = AC^2 - AC.AB$, and $AD^2 = AC^2 - AC.BC$, or $AB = (AC^2 - CD^2) \div AC = 5.9090085$, and $BC = (AC^2 - AD^2) \div AC = 8.0674428$.

The property $CD^2 = AC^2 - AC.AB$,* which holds good in any right angled $\triangle$, may be thus demonstrated. Draw the radii DE, DF, DG; then CG = CF, and AG = AE; hence AC(= CG + AG) = CF + AE = BC + AB − 2DF, ∴ DF = EB = ½(BC +

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* This property may be otherwise proved thus: In AC take AH equal to AB, and join DH, DB; then the triangles ADH, ADB, having the equal angles DAH, DAB, AH equal to AB, and AD common, will also have the angle DHA equal to DBA half a right angle, or 45 degrees: and consequently the angle DHC is 135 degrees, which is also equal to the angle ADC; therefore the triangles CHD, CDA are similar: whence CH.CA equals DC^2 which equals (AC − AB).AC. Q.E.D.

$AB - AC)$. Again $CF = CG = AC - AG = AC - AE = AC - AB + BE = AC - AB + \frac{1}{2}(BC + AB - AC) = \frac{1}{2}(AC - AB + BC)$, and $CD^2 = DF^2 + CF^2 = \frac{1}{4}(BC + AB - AC)^2 + \frac{1}{4}(AC - AB + BC)^2 = \frac{1}{4}(2AC^2 - 4AC.AB + 2AB^2 + 2BC^2) = \frac{1}{4}(4AC^2 - 4AC.AB) = AC^2 - AC.AB$. Q. E. D.

Ingenious solutions to this question were also received from Messrs. Bronwin, Shepherd, Holt, and Godward.

(263) *By* Mr. H. LIGHTBOWN, *Blackburn.* †

In what time will the amount of an annuity of 60l. per annum be equal to the amount of 800l., at 5 per cent. per annum, compound interest?

By MR. JAMES JERWOOD.

Put £60 $= a$, £800 $= P$, $1.05 = R$, $·05 = r$; and let t denote the time required. Then by *Leybourne's Ladies' Diaries, Vol.* III, *page* 199, $t = \frac{\log. a - \log(a - Pr)}{\log. R}$ $= \frac{0{\cdot}4771213}{0.0211893} = 22.51709$ years, the time required.

By MR. JOHN BAINES.

Let $x =$ the number of years, then $\frac{1.05^x - 1}{1.05 - 1} \times 60 = 1.05^x \times 800$, or $(1.05^x - 1) \times 1200 = 1.05^x \times 800$; this reduces to $3 \times 1.05^x - 3 = 2 \times 1.05^x$, or $1.05^x = 3$, that is, log. $1.05 \times x =$ log. 3; hence $x = \frac{\log. 3}{\log. 1.05} = 22.517$ years.

Ingenious solutions of this question were given by Messrs. Bronwin, Holt and Godward.

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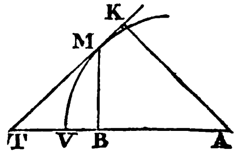
† This gentleman's ingenious communications to the Third Number of this Volume, did not reach the editor till a month after that number had been put to press.

(264) *By* W. MARRAT, A.M., *Late Editor of the Boston Enquirer, the Monthly Scientific Journal, Author of a Treatise on Mechanics, and F.P.S. of New York.*

Determine the curve VM, such that all the perpendiculars AK, drawn from a given point A in the axis to the tangent MT, shall be of the same length.

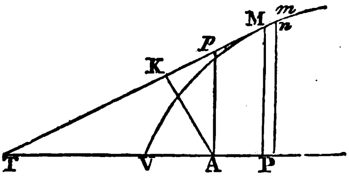
By MR. JOHN HUNTINGTON.



Let A indicate the given point in the axis, BV any absciss, and BM, MT, the corresponding ordinate and tangent respectively. Demit AK perpendicular to MT, which per question is a constant quantity; and since AV will be perp. to the tangent at V, AK $=$ AV, which assume $= a$; also put BV $= x$, and BM $= y$; then AB $= a - x$, BT $= \frac{y\dot{x}}{\dot{y}}$, AT $= \frac{y\dot{x}}{\dot{y}} + a - x$, and MT $= \frac{y}{\dot{y}}(\dot{x}^2 - \dot{y}^2)^{\frac{1}{2}}$. $\therefore$ by sim. $\triangle$s, AT : AK :: MT : BM; that is, $\frac{y\dot{x}}{\dot{y}} + a - x : a :: \frac{y}{\dot{y}}(\dot{x}^2 + \dot{y}^2)^{\frac{1}{2}} : y$; whence $y\dot{x} + a\dot{y} - x\dot{y} = a(\dot{x}^2 + \dot{y}^2)^{\frac{1}{2}}$. In flux. making $\dot{x}$ const. is $\dot{x}\dot{y} + a\ddot{y} - \dot{x}\ddot{y} - \dot{x}\dot{y} = a \times \frac{\dot{y}\ddot{y}}{(\dot{x}^2 + \dot{y}^2)^{\frac{1}{2}}}$ reduced $\dot{y} = \frac{(a-x)\dot{x}}{(2ax-x^2)^{\frac{1}{2}}}$ the fluent of which is $y = (2ax - x^2)^{\frac{1}{2}}$, intimating that the curve in question is a circle whose centre is A and radius is AK, which we well know to be the case from Geometrical principles: The point K therefore coincides with M.

Mr. Godward answered this Question.

By the Rev. B. Bronwin.



Let VM be the curve, and A the given point. And put AK $= a$, AP $= x$, and PM $= y$. Then by sim. $\triangle$s $\dot{y} : \dot{x} :: y : \frac{y\dot{x}}{\dot{y}} =$ TP; therefore $\frac{y\dot{x}}{\dot{y}} - x =$ TA. Again by sim. $\triangle$s $\surd(\dot{x}^2 + \dot{y}^2 : \dot{y} :: \frac{y\dot{x}}{\dot{y}} - x : \frac{y\dot{x} - x\dot{y}}{\surd(\dot{x}^2 + \dot{y}^2)} =$ AK $= a$. Or $y\dot{x} - x\dot{y} = a\surd(\dot{x}^2 + \dot{y}^2)$. Now this equation is the example solved at page 387, *Traite Elementaire de Calcul Differentiel, &c., par La Croix.* From whence it appears that the particular fluent is $a^2 - x^2 = y^2$, and the complete fluent $y = Ax + B$. The former belongs to a circle, the centre of which is A, and rad. AK $= a$; the latter to a straight line, (TM for instance,) the direction of which with respect to AP is determined by the arbitrary quantity B.

Let Ap be perpendicular to AP. Then by first making x, and then $y = 0$, we have $\frac{\text{KA}.p\text{A}}{\text{K}p} =$ TA; or $\frac{a\text{B}}{\surd(\text{B}^2 - a^2)} = \frac{\text{B}}{\text{A}}$. Therefore $\text{A} = \frac{\surd(\text{B}^2 - a^2)}{a}$. By making B to vary from ∞ to a, and from a to ∞, this line will evidently be a tangent to the circle at every point M of its periphery.

(265) *By* Mr. R. Smith, *Manchester.*

At the game of All Fours what are the odds against the dealer having the Jack, allowing one turn-up card?

By the Proposer and the Rev. B. Bronwin.

For the dealer to have the Jack according to the law of the game, he must either turn it up, or else he must not turn it up and receive it in 6 cards out of 51. Now the probability of turning the Jack up is $\frac{1}{13}$ and that of failing $\frac{12}{13}$, : Admit this event to happen; then the probability of receiving the Jack in 6 cards out of 51, is $\frac{6}{51}$ or $\frac{2}{17}$, and $\frac{12}{13} \times \frac{2}{17} = \frac{24}{221}$ the probability of not turning the Jack up and receiving it in 6 cards out of 51. Therefore $\frac{1}{13}$ added to $\frac{24}{221}$ make $\frac{41}{221}$ the probability of the dealer having the Jack, and $1 - \frac{41}{221} = \frac{180}{221}$ the probability to the contrary. Conseq. the odds are 9 to 2 against the dealer having the Jack, allowing one turn-up card.

By Mr. William Godward.

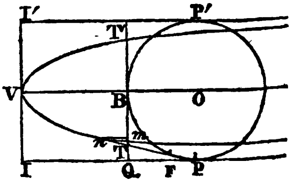
The probability of turning up a blank is $\frac{12}{13}$: now, admitting this event to happen, then there remain 51 cards among which is the trump-jack, and the probability of receiving it in 6 of these 51 cards, is $\frac{6}{51}$.— Therefore the probability of turning up a blank, and receiving the trump-jack is $\frac{12}{13} \times \frac{6}{51} = \frac{24}{221}$.

Again, the probability that the dealer turns up a Jack is $\frac{1}{13}$. Hence $\frac{1}{13} + \frac{24}{221} = \frac{41}{221}$ the probability of the dealer holding the Jack; and $1 - \frac{41}{221} = \frac{180}{221}$ the probability of the contrary; consequently the odds are as 180 to 41, or as 9 to 2 nearly.

(266) *By* Mr. W. Settle, *Leeds.*

Find the equation and quadrature of a curve, such that all the circles touching the tangent, sub-tangent, and ordinate, shall be of the same magnitude.

By Plus Minus.



Let TVnT be the required curve and O the given circle touching the tangent FT, subtangent QF, and ordinate QT, V being the vertex, and II′ (= the diameter of the generating circle) the

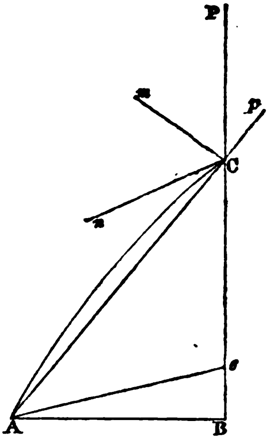
tangent at V. Put VI $=$ BQ $= r$, VB $= x$, BT $= y$, $nm = \dot{x}$, mT $= \dot{y}$, then QT $= r - y$, and per sim. $\triangle$s, $\dot{y} : \dot{x} :: r - y : \frac{\dot{x}}{\dot{y}}(r - y) =$ QF: hence FT $=$ $\frac{r - y}{\dot{y}}\sqrt{(\dot{x}^2 + \dot{y}^2)} = 2\text{BQ} - \text{QT} - \text{QF} = r + y + \frac{\dot{x}}{\dot{y}}(r - y)$, or $\dot{x} = \frac{2ry\dot{y}}{r^2 - y^2}$; the fluent of which is $x = - r \times$ hyp. log. $(r^2 - y^2)$; but when $y = 0$, $x = - r \times$ hyp. log. r^2: hence the fluent corrected gives $x = r \times$ hyp. log. $\left(\frac{r^2}{r^2 - y^2}\right)$ the req. equation of the curve: from which it appears that when $\pm y = r$, the value of x is infinite, or PI, P′I′ perpendiculars to II′ are asymptotes to the curve. Now the fluxion of the area VBT, or $y\dot{x} = \frac{2ry^2\dot{y}}{r^2 - y^2}$; the correct fluent of which is $r^2 \times$ hyp. log. $\left(\frac{r + y}{r - y}\right)$ $- 2ry =$ area of the space VBT. To find the length of the curve VT, we have $\sqrt{(\dot{x}^2 + \dot{y}^2)} = \sqrt{\left(\frac{2ry\dot{y}}{r^2 - y^2}\right)^2 + \dot{y}^2} = \left(\frac{r^2 + y^2}{r^2 - y^2}\right) \cdot \dot{y} = \frac{r^2\dot{y}}{r^2 - y^2} + \frac{y^2\dot{y}}{r^2 - y^2}$, $\therefore$ by integration VT the length of the curve $= r \times$ hyp. log. $\left(\frac{r + y}{r - y}\right) - y$.

Ingenious solutions were also given to this question by the Rev. B Bronwin, and by Messrs. Huntington, Godward and Baines.

(267) *By* Mr. J. Jerwood, *Ploughill.*

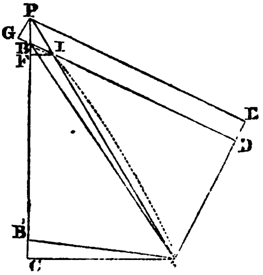
A perfectly elastic ball dropped from a point 100 feet above the horizon, impinged on the top of an inclined plane, whose base is 40 feet, and after its reflection struck the horizon exactly at the foot of the plane: Required the plane's elevation.

By the Rev. B. Bronwin.



Let P be the place fallen from, AC the plane, nC the line of reflection, and mC perpendicular to AC. Then by Wood's Mechanics (Art. 437) we have AC $= \frac{\sin.nCA \times \sin.nCP \times 4CP}{\cos.CAB^2} =$ (since the $\angle$ACB $=$ PCp $= n$CA.) $\frac{\sin.ACB\ .\ \sin.2CAB\ .\ 4CP}{\cos.CAB^2} =$ (by trig.) $\frac{\sin.ACB\ .\ 2\sin.CAB\ .\ \cos.CAB\ .\ 4PC}{\cos.CAB^2} = 8CP\ .\ \sin.CAB$. But CB $=$ AC . sin.CAB. Therefore $AC^2 = 8CP\ .\ CB$. Let CB $= x$, and we have $AC^2 = AB^2 + BC^2 = 40^2 + x^2 = 8(100 - x)x$; and $x^2 - \frac{800}{9}x = -1600 \div 9$; or $x = 86.842$ and 2.047. The former value of x gives 65° 16′ 9″, the latter 2° 55′ 43″ for the angles of elevation BAC, BAc. Hence it appears that there are two planes that will answer the conditions of the question.

By AMICUS.



Let AC be the given base and PC the given height fallen from, and suppose the position of the plane AB determined. Draw BI = BP, making the ∠ ABI = ABC; then, because the ∠s of incidence and reflection are equal, BI will be the direction of the ball after impact. On IB demit the perpendiculars PG, AD: complete the rectangle PEDG, and draw IF || to AC cutting CP in F: then the right-angled triangles PGB IFB being similar, and having equal hypothenuses BP, BI, are equal in all respects; therefore PG = IF: and the right-angled triangles ACB, ADB being also similar, and having the common hypothenuse AB, are equal in all respects; therefore AC = AD. Now, by the theory of Projectiles, FI = $\frac{1}{4}$AC; but FI = PG = ED: therefore AE = $\frac{5}{4}$AC is given; and since AP the hypothenuse of the right-angled triangle AEP is given, the angle PAE is given; and the angle PAE being given, the angle CAB, which is the half-sum or half-difference of these angles, is therefore given. *Erga solutum.*

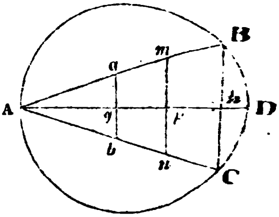
In the present instance AC = 40, PC = 100; hence AP = $10\sqrt{116}$ and the ∠ PAC = 68° 11′ 54″. Also in the △ PEA, PA = $10\sqrt{116}$ and AE = $\frac{5}{4}$AC = 50; hence the ∠ PAE = 62° 20′ 20″: The half sum of these ∠s gives the ∠ CAB = 65° 16′ 7″, and the half difference gives CAB′ = 2° 55′ 47″, either of which elevations answers the conditions of the Prob.

It was answered by Messrs. Godward, Baines, and Holt.

(268) *By* Mr. JOHN MACAULEY, *Gill-street, Liverpool.*

If in a given circle there be drawn from a point in its circumference any two equal chords, these chords will form an angular pendulum which will always vibrate in the same time, whatever may be the angle contained by the equal chords : Required the demonstration.

By the Rev. B. Bronwin.



Let AB, AC be the two equal chords. Then if *ab* bisect AB, AC in the points *a* and *b*, and be itself bisected in *g* by the diameter AD ; *g* will be the centre of gravity of the pendulum. Let now *mpn* be any line || to *ab* or BC, and let A*m* $= x$. Then fluent $2x^2\dot{x} = \frac{2}{3}x^5 =$ (when $x =$ AB) $\frac{2}{3}\text{AB}^3$; and the distance of the centre of oscillation from A $= \frac{\frac{2}{3}\text{AB}^3}{2.\text{AB.A}g} = \frac{\text{AB}^2}{3\text{A}g} = \frac{\text{AD.A}h}{3\text{A}g}$.

$= \frac{\text{AD.2A}g}{3\text{A}g} = \frac{2}{3}\text{AD}$; which being invariable, the time of oscillation must be invariable also.

But if the axis of suspension, instead of being perp. to the plane of the circle, be laid in that plane, the time of vibration is no longer invariable; for in this case the above distance will come out $\frac{4}{3}$A*g*.

Ingenious solutions were also given by Messrs. Godward and Shepherd.

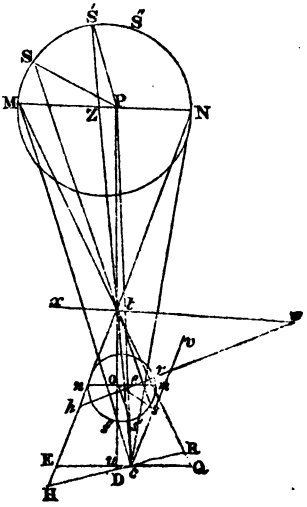
(269) *By* Mr. C. Holt, *Houghton, near Chorley.*

If an object be placed on the horizon, the locus of the top of its shadow described by the sun will be an hyperbola, if the co-lat. of the object be greater than the declination of the sun ; if the co-lat. be equal to the declination, the locus will be a parabola ; if the co-lat. be less than the declination, the locus will be an ellipse ; if the co-lat. be nothing, or one of the poles the place of the object, and the sun have any assigned declination, the locus of the shadow will be a circle; but if the sun be in the equinox, or have no declination, the locus will be a straight line, wherever on the earth's surface, except at the poles, the object be placed —These properties of nature have been analytically investigated before ; but they are here proposed to be synthetically demonstrated.

By the Rev. B. BRONWIN *and the Proposer.*

Let the circle $s\,s'\,s''$ represent the sun's diurnal course, t the top of any object on the surface of the earth, and c the earth's centre. And let tc be joined and produced to meet the plane of the circle SS′S″ in Z. Then, NPZM being drawn, M will be the place of the sun at noon, and N at midnight. And if $mss's''n$ be any plane || to MSS′S″N; the points m, s, s'', &c. will be the shadows of t when the sun is at M, S, S′, &c. Now let Pt joined meet this last plane in O, and the equator EQ and horizon HR in u and D respectively. Then if SP, S′P &c. and os, os' &c. be joined, we have by sim. △s SP : so :: Pt : to :: S′P : $s'o$ &c. But SP = S′P = S″P. Therefore $so = s'o = s''o$; and the intersection of the plane $mss's''n$ with the cone of rays ts, ts', &c. is a circle. Also the intersection of EQ with the same cone is a circle, whcse centre is u; because the equator is || to the plane SS′S″.

Again, join CP, NC, and MC. Then CP is perpendic. to MN and EQ. The ∠ NCQ = MCE is the sun's declination. And the ∠ RCQ = PCZ is the complement of the lat. Also the ∠ tEQ = NCQ — tNC, the ∠ tQE = MCE — tMC, and therefore tEQ = tQE + tMC — tNC. The ∠s E and Q then of the △ tEQ differ only by the diff. of the sun's parallaxes at N and M; and conseq. the cone $tmsn$ may be considered as a right cone without any material error.



CASE 1. Let the $\angle$ RCQ be greater than NCQ. Then HR must lie between CN and CP; and if produced between those lines, would cut *t*N in some point between *t* and N. Conseq. *hr* upon the earth's surface $\parallel$ to HR, being produced must meet *t*N the side of the opposite cone; and so the section of which *hr* is the axis, by what is shewn by the writers on conic sections, is an hyperbola.

CASE 2. Let the $\angle$ QCR = QCN. Or rather draw C*v* $\parallel$ to EN; and let CR coincide with C*v*. Then *hr* $\parallel$ to QR is also $\parallel$ to EN; and the section *hr* is a parabola. But the $\angle$ *v*CN = CN*t* = sun's parallax at N, is a very small $\angle$. When therefore EQ coincides with CN, the section may also be considered as a parabola, for it differs very little from one.

CASE 3. Let QCR be less than QCN; or rather than QC*v*. Then because CR lies between CQ and C*v*, it must cut E*t* in some point *h*, and the section must either be a circle or an ellipse. But the $\angle$ *t*EQ has been shewn to be = to *t*QE, (neglecting parallax) that is, less than *t*RH. The cone therefore is not cut in sub-contra directions by EQ and HR, and conseq. the the section HR, and also *hr*, must be an ellipse. Yet when the $\angle$ RCQ becomes so small as only to = the diff. of the parallaxes at M and N, it will be a circle. The reason why QCR must be less than QC*v* is, because otherwise CR would not meet *t*E.

CASE 4. Let now *t* be at the pole. Then *z* and P coincide; also HR and EQ; and conseq. *hr* and *nm*. The section therefore in this case is the circle $mss's''n$.

CASE 5. Let the $\angle$ NCQ vanish, or NC coincide with CQ. And suppose the parallactic $\angle$ tNC to vanish, or C to move up to and coincide with *t*. Then all the rays M*tm*, S*ts*, S′*ts*′ &c., will fall into the plane *xtw* drawn through *t* $\parallel$ to EQ. And the shadow they cast will be the intersection of that plane with the plane *hr* produced in some point *w*, and therefore a straight line.

Or, allowing for parallax, let the $\angle$ NCQ = *t*NC. Then *t*N will be $\parallel$ to EQ, and all the rays will fall into the plane *xtw* as before. When the point *t* is in the pole, it is evident the sun's rays will not touch the earth, but will form a cone upward. Q. E. D.

(270) *Prize Question, by* ASTRONOMICUS.

Find the length of the tropical year:
1. From the transits of Mercury over the Sun's disc.
2. From the oppositions of Mars.
3. From the oppositions of Saturn.

By the REV. BRICE BRONWIN.

In proposing a problem for solution, we may intend, either the discovery of something useful in practice, or only the developement of amusing theory, merely to shew what is possible to be done. Of the latter kind I presume this problem to be: And under this idea, I shall suppose that we are furnished with accurate Astronomical Tables. From these Tables let *t*, the actual time of conjunction or opposition, be found, the equations or corrections for perturbations being applied. Now this time is not affected by the longitude, or the place of the equinox, or length of the tropical year, as is evident, because it is not at all dependent upon them. It matters not whether the longitude be reckoned from the first point of Aries or from any other point; nor whether that point be moving or fixed; nor whether the length of a degree be longer or shorter: In either case *t* will result the same. But we must not take from the tables the longitude corresponding to *t*, for to do that, we should make use of what we are in quest.

Now whether we use past oppositions or future ones, we must have, from observations made at the time, the diurnal motions in right ascension of the sun and planet, and also the planet's declination. And as we are supposed not to know the situation of the equinox relative to the fixed stars, let us assume *r* for the right ascension at the first observation. From this assumption let the corresponding longitudes of the sun and planet for several days be computed; and thence the time of opposition in the usual way. If this time agrees with t found as above, the assumption is right: If not, the error must be marked, another right ascension assumed, and the process repeated, till a right ascension is obtained which gives that time. Let the corresponding longitude of the planet or sun be noted.

In the same manner the planet's or earth's longitude must be found at some other opposition, happening very nearly at the same point of the orbits; which, in the case of Mars or Saturn, may be done. Then, from the sun's diurnal motions in longitude at one of the oppositions, the time of describing the difference between the two longitudes must be computed in the usual way; and being added to, or subtracted from the time of opposition, (as the case may require,) we shall have two times in which the earth had equal longitudes. And this period, being divided by the number of revolutions the earth has made in it, will give the length of the tropical year as required.

In the case of the transits, we must have the diurnal motions of Mercury and the sun in right ascension, found by observation a day or two before and after the conjunction, and also the planet's declination, as in the opposition of a superior planet, if Mercury can be seen sufficiently for the purpose. But if he cannot, his diurnal and horary motions in latitude and longitude may be taken from the tables. Then we must assume r, the right ascension on one of the days of observation, and from this assumption we must find t', the time from the conjunction to the contact of the limbs; and also t'', the time by which this contact is accelerated or retarded by parallax, the modes of doing which are known, and explained in most elementary treatises on Astronomy. This done, we have $t - t' \pm t'' =$ the time of apparent contact, as seen from Greenwich, or the place to which the tables are adapted. If this time agrees with the observed time of contact, (which must be accurately noted,) the assumption is right. If not, another must be made, and the operation repeated, till the true right ascension and consequently the true longitude, are obtained. The like operations must be used for another transit, and the length of the tropical year found from the result, exactly as in the case of the oppositions.

Thus has been shewn the possibility of doing the thing proposed, and how it may be effected. And perhaps oppositions and transits may be selected, attended with circumstances that may greatly facilitate the computation and solution of the problem, but which do not appear from mere theory.

In the above analysis, it will be seen that in taking the diurnal and horary motions of Mercury, if requisite, from the tables, an indirect use has been made of the thing we were in search of, because the latitude of the planet depends upon the inclination of its orbit to the ecliptic and the place of its nodes, which were at first determined from observations made upon the meridian. But this will not affect the result; besides, it is a common thing in Astronomical investigations.

By the Proposer.

1. From the observations of the transit of Mercury on November 6th 1631, Cassini found the time of the conjunction to be at 19h. 50m. and the true place of Mercury 1s. 14° 41′ 35″. On November 9th, 1723, at 5h. 29m. the conjunction was in 1s. 16° 47′ 20″ or 2° 5′ 45″ beyond the place of the first observation. Now as 8″.8 the apparent diameter of Mercury at the ascending node : 8″.75 the Sun's parallax :: 2° 5′ 45″ the difference of the true places of ☿ : the difference of the mean longitudes of the Earth at the times of the conjunctions nearly = 2° 5′. Consequently in 92 years (of which 22 were bissextiles) 2d. 9h. 39m. or 33604.40208 days, the Earth had made 92rev. 2° 5′ = 92.005787 revolutions. Then 33604.40208 ÷ 92.005787 = 365.242265 days, or 365d. 5h. 48m. 51″.6, the length of the tropical year from these observations.

2. From the observations of Ptolemy, Mars was in opposition 130 years after Jesus Christ, on December